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(54) Title: METHODS OF PROVIDING MEDICAL INFORMATION AND RELATED SYSTEMS AND COMPUTER PROGRAM PRODUCTS

(57) Abstract: Methods of displaying operation scheduling information can include retrieving scheduling information for scheduled operations in a plurality of operating rooms of a hospital area over a predetermined time period. The scheduling information for the scheduled operations can include a patient identification and a procedure identification. Current status information is retrieved for at least one of the scheduled operations while in progress wherein the current status information is selected from one of a plurality of milestones of a surgical operation while in progress. A table of scheduled operations over the predetermined time period is provided for display at a client device wherein for a respective scheduled operation, the table includes the respective patient identification and procedure identification wherein the table further includes the current status information. Related methods, systems, and computer program products are also discussed.

## **METHODS OF PROVIDING MEDICAL INFORMATION AND RELATED SYSTEMS AND COMPUTER PROGRAM PRODUCTS**

### **RELATED APPLICATIONS**

The present application claims priority from U.S. Provisional Application No. 60/322,865 filed September 17, 2001, entitled "A Web-Based Operating Room Status-Monitor And Anesthesia". The disclosure of U.S. Provisional Application No. 60/322,865 is hereby incorporated herein in its entirety by reference.

### **FIELD OF THE INVENTION**

The present invention relates to methods, systems, and computer program products for information processing.

### **BACKGROUND**

Only about five percent of hospitals in the US routinely use an anesthesia information system for recording an anesthetic record, despite that fact that the practice of anesthesia, with its highly structured data, lends itself well to these systems. One reason for this is financial, as yet there appear to be few clear indications of a significant return on investment for these systems, which tend to be expensive. There may also be controversy surrounding the clinical benefits of these systems, with some anesthesia staff reluctant to invest in systems because of entrenched attitudes to a "spy-in-the-cab", because they would like control over the recording of automated data for a case, and/or because they fear the recording of "the ugly truth". The main vendors have made little progress in penetrating this market over the past 10 years for these and/or other reasons.

Anesthesia Information Systems (AIS) have evolved significantly since the 1st generation Duke Automated Monitoring Equipment (DAME) system in 1972. Initially they were simple recording devices using the hardware available at the time, which tended to be large and/or unreliable. User input to the DAME was by keyboard and bar codes. A diagram of a first generation DAME system is illustrated in Figure 1. As shown, the DAME system included one or more monitoring carts 101, a data manager 103, and a printer 105 coupled through a DMXNET Network 107. Each

monitoring cart 101 could include a DEC LSI-11/02 microcomputer and a barcode reader. The data manager could include a DEC PDP-11/23 minicomputer, a 5Mb hard drive, 256K RAM, and a custom built operating system.

The second generation of AIS was based on PC technology, with more reliable operating systems, software and hardware. The Arkive AIS was an example of this, and the largest installation of this type anywhere in the world was believed to be at Duke University Medical Center in Durham, North Carolina. A diagram of the Arkive system is illustrated in Figure 2. User input was by touch screen plasma display. These were file serving, networked systems with rudimentary Paradox or Access databases usually running on a Novell platform. As shown in Figure 2, an Arkive system could include a plurality of workstations 201, a Novel network file server 203, a plurality of network printers 205, a mirrored database 207, and data storage 209, coupled by network 211.

The third generation of AIS is that of the current installed base. Two tier or three tier client/server systems now use robust relational databases such as Microsoft SQL Server, Sybase Adaptive Server, or the like. The client applications are usually 'fat' in that a great deal of processing is done on the client, usually because of the requirement to handle monitored data streams from equipment attached to the patient. Systems from Draeger Medical Inc., Philips Medical Systems Inc., GE, Surgical Information Systems Inc., and PICIS Inc. generally have this architecture at their heart. The Draeger system, referred to as the Saturn Information System or "Saturn", is illustrated in Figure 3. As shown in Figure 3, the Saturn Information System can include a plurality of clinical workstations 311, a plurality of non-clinical workstations 313, and a database server 315 coupled by AIS network 317.

The current generation of AIS generally uses heavyweight client software ("fat client") on dedicated workstations. The progression to 'thin client' solutions may be slow due to the desire to perform significant data processing of monitored data streams at the client devices (i.e. clinical workstations), and the desire for redundancy of information on the client in the event of a network failure. The usual architectural solutions to this are local database structures, which replicate to the main server. The vendors appear to have spent most of their effort making these complex software systems work reliably in a demanding clinical environment, and they appear to have mostly succeeded.

### **SUMMARY**

According to embodiments of the present invention, methods of displaying operating room scheduling information can include retrieving scheduling information for scheduled operations in a plurality of operating rooms of a hospital area over a predetermined time period. The scheduling information for the scheduled operations can include a patient identification and a procedure identification. Current status information is retrieved for at least one of the scheduled operations while in progress wherein the current status information is selected from one of a plurality of milestones of a surgical operation. A table of scheduled operations over the predetermined time period is provided for display at a client device wherein for a scheduled operation, the table includes the respective patient identification and procedure identification wherein the table further includes the current status information.

According to additional embodiments of the present invention, methods of retrieving medical information can include retrieving scheduling information for scheduled operations meeting a predefined criteria wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification. A table of all scheduled operations can be provided for display at a client device wherein for each scheduled operation, the table includes the respective patient identification and procedure identification. Selection of one of the patient identifications from the table of scheduled operations meeting the predefined criteria can be accepted, and responsive to accepting selection of the patient identification, at least one case identification corresponding to the patient identification can be retrieved for display at a client device.

According to yet additional embodiments of the present invention, methods of displaying anesthesia records can include operations performed by data processing systems. In particular, a data processing system can accept entry of information identifying a surgical operation wherein the information is entered via a client device in communication with the data processing system. Anesthesia data corresponding to the identified surgical operation can be retrieved, and an anesthesia record can be built using the retrieved anesthesia data. Secure communication of the anesthesia record can be provided to the client device for display of the anesthesia record at the client device.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

Figure 1 is a diagram illustrating a DAME Anesthesia Information System according to the prior art.

Figure 2 is a diagram illustrating an ARKIVE Anesthesia Information System according to the prior art.

Figure 3 is a diagram illustrating a Saturn Information System according to the prior art.

Figure 4 is a diagram illustrating information systems, methods, and computer program products according to embodiments of the present invention.

Figure 5 illustrates use of a test server certificate according to embodiments of the present invention.

Figure 6 illustrates a Choices page according to embodiments of the present invention.

Figure 7 illustrates the Tomcat application server (open source software from the Jakarta Project, <http://jakarta.apache.org>) running in a Java Virtual Machine on a server according to embodiments of the present invention.

Figure 8 illustrates Tomcat and an Imageserver running in a Java Virtual Machine on a server according to embodiments of the present invention.

Figures 9 and 10 illustrate packages associated with ORview according to embodiments of the present invention.

Figure 11 illustrates an organization of database connectivity according to embodiments of the present invention.

Figure 12 illustrates image processing techniques according to embodiments of the present invention.

Figure 13 illustrates pages of information and interrelations therebetween according to embodiments of the present invention.

Figure 14 illustrates a Choices page according to embodiments of the present invention.

Figure 15 illustrates a Search page according to embodiments of the present invention.

Figure 16 illustrates a Search Results page according to embodiments of the present invention.

Figure 17 illustrates an Operating Room Status Page according to embodiments of the present invention.

Figure 18 illustrates display of "break relief" information according to embodiments of the present invention.

Figure 19 illustrates operations of generating a user schedule according to embodiments of the present invention.

Figure 20 illustrates an Anesthesia Record Page according to embodiments of the present invention.

Figures 21 and 22 illustrate event bars according to embodiments of the present invention.

Figure 23 illustrates graphical vital signs according to embodiments of the present invention.

Figure 24 illustrates operations of generating an anesthesia record page according to embodiments of the present invention.

Figure 25 illustrates security features according to embodiments of the present invention.

Figure 26 illustrates an authentication schema according to embodiments of the present invention.

Figure 27 illustrates a password challenge according to embodiments of the present invention.

Figure 28 illustrates a Change Password Page according to embodiments of the present invention.

Figure 29 illustrates an audit scheme according to embodiments of the present invention.

Figure 30 illustrates organizations of registrations and passwords according to embodiments of the present invention.

Figures 31-34 are flow charts illustrating methods, systems, and computer program products according to embodiments of the present invention.

Figure 35 is a block diagram illustrating information processing environments according to embodiments of the present invention.

### **DETAILED DESCRIPTION**

The present invention now is described more fully hereinafter with reference to the accompanying drawings, in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these

embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art.

Embodiments of the invention can include a set of web-applications which can extend the functionality of anesthesia information systems by adding, in some embodiments, a web "wrapper" around the data collected by these systems. Embodiments of the invention can dramatically increase the availability and derived functionality of the patient information. Embodiments of the invention can provide additions in functionality including a web-based operating room status monitor, a web-based search mechanism for previous anesthesia records and/or a dynamic, graphical web-based representation of real-time and past anesthesia records. Embodiments of the invention can make these functions available on the Internet with a robustness sufficient for production use in a major hospital. Moreover, embodiments of the invention can act as a hosting service and make records and schedules available for multiple hospitals using various anesthesia information systems. This capability may be limited only by the power of the hardware and the available Internet connection speed.

Using embodiments of the invention, staff can look up anesthesia and postoperative care records from any Internet client in a secure fashion. They can also view the status of running or scheduled cases in their operating room suite from any Internet client, and drill down if desired, for example using HTML links, to view the case in a particular operating room. Security of patient and staff information can be maintained.

The increase in functionality offered by embodiments of the invention may open the market for Anesthesia Information systems. Its advantages of the widespread dissemination of case and schedule information to the anesthesia, nursing, and/or administrative staff inside and/or outside their normal workplace (i.e. at home, in doctor's offices, in break areas, in administrator's offices, etc.), may alone justify the cost of perioperative information systems on the basis of an increase in clinical case awareness for the patient, workplace convenience for clinical staff and a powerful efficiency tool for administrators.

Embodiments of the invention can use a middle tier web application server functionally set between the Anesthesia Information System database and the Internet. Requests for information from Internet clients are met by the application server layer, which queries the database, processes the data, draws the graphics and returns HTML

pages with embedded images to the original Internet client. Figure 4 illustrates embodiments of the invention in block diagram format.

As shown in Figure 4, information processing systems according to embodiments of the present invention can include an application server 411 coupled between a database server 413 of an anesthesia information system and the internet 415 or other wide area network. As discussed above, an anesthesia information system can include a plurality of workstations 421 coupled with a database server 413 over a local area network 425 within a hospital. The application server 411 can retrieve desired data from the database server 413, use the retrieved data to build records and tables for secure distribution over the internet 415 to authorized internet client devices 417.

Embodiments of the invention can be used by anyone who needs access to perioperative data. These uses can include:

1. Any clinical staff wanting to look up anesthesia records related to a patient. This could be from anywhere with access to an Internet browser. For example embodiments of the invention can be incorporated as a link in a web-based Medical Information System thus providing a viewable anesthesia record anywhere in the hospital. Until now, unwieldy solutions for storing the Anesthesia record in the Common Data Repository (CDR) have been contemplated, such as creating an Adobe PDF image of the record, and storing that. Embodiments of the invention can provide an elegant solution that can make the use of scanned images of paper anesthesia records obsolete. There is no need to duplicate the data, because existing data can be viewed in a novel and robust format.
2. Remote users who wish to access anesthesia records. For example, to give an expert opinion on a live running case in the operating room, or to provide an anesthetic record to an outside hospital when they request information about a patient's anesthetic history. Perhaps the most common use may be anesthesia providers looking up old records from their offices or homes planning their approach to the next day's cases (there is a considerable patient safety element in this).
3. Local users of information systems *in the operating rooms* can use embodiments of the invention to provide a more comprehensive and readable view of a case than their "fat client" record provided by current Anesthesia Information Systems, which may be optimized for data input.



4. Users who need to remotely access scheduling information. For example, "What cases am I doing tomorrow?"
5. Administrators managing Operating Room suites and/or recovery areas and/or patient waiting areas and/or bed control functions can use live status monitors of embodiments of the invention.
6. Using embodiments of the invention as a status monitor for viewing in office rooms or "Big Board" central planning areas. Using multi-head video cards, embodiments of the invention can be spread over multiple flat panel displays to provide a status of all the rooms in a suite.
7. For Quality Assurance and Audit. Simple database queries can extract cases with poor outcomes or cases that have been otherwise flagged for further analysis. A link to a reference for an anesthetic record can be emailed securely to the hospital's QA committee and risk analysis department.
8. Embodiments of the present invention can also be used to provide hospital inventory control and billing information. For example, Anesthesia Records can be provided to the hospital pharmacy so that drugs used during an operation can be inventoried and billed more accurately.
9. Using embodiments of the present invention, care providers and/or administrators can look up personalized information about their clinical practice using a feature in ORview termed "MyQI". This area can enable users to generate dynamic and active views of data regarding their clinical practice in comparison to that of their peers. This functionality can thus be used to influence clinical practice. Personalized information relating to the practice of a particular physician can be provided. A table of all cases for which a user is listed as having worked on can be generated. Such a table, for example, can include information for each case such as the case information provided in Figure 16. Statistical data can also be provided for a particular physician. For example, a graphical representation can be provided illustrating a number of cases handled by day, week, or month over a designated time period. Comparisons can also be provided between a particular physician and peer physicians. For example, average drug use(s), average cost(s), average or reported event(s), etc. for a physician over a period of time can be compared to a comparable average(s) of peer physicians over the same period of time.

A detailed description of system architectures according to embodiments of the invention now will be provided. These detailed embodiments will collectively be referred to as ORview.

The ORview welcome page, "orview.jsp", directs users to the various components of ORview. The welcome page resides on a web application server within its Secure Sockets Layer (SSL), so a request for the welcome page is met with an offer of a digital server certificate which must be accepted to continue. The certificate offers the application server's public key of a paired RSA\_5 128 bit encryption key pair. This is 'strong' encryption and provides that from this point the user session will continue over an encrypted link between web-client and web-server.

The ORview development software uses a test server certificate from Verisign Inc., so the screen 511 illustrated in Figure 5 can be served suggesting that the key being offered is from an untrusted site and asking if the user would like to accept it. This is normal SSL protocol. Purchasing a production server certificate may allow automatic SSL without this step.

The welcome page for the application, orview.jsp, can act as a redirector, pointing new users to the registration forms, and transparently pointing established users to the application itself. ORview.jsp and other JSPs in ORview can use JavaServer Pages (JSP) technology from Sun Microsystems, Inc. The first clinical page or Choices Page 611 of ORview is "choices.jsp" which can be provided as illustrated in Figure 6. A link to orview.jsp from any web page can initiate the ORview application.

ORview can use Tomcat V3.2 as a servlet and JSP container, otherwise known as an "application server". Tomcat is freely downloadable from the Internet and is part of the Jakarta open source project. Tomcat is a pure Java application and can run in a Java Virtual Machine (VM) on a Windows 4.0 NT server 711 as illustrated in Figure 7.

Tomcat 3.2 is Sun's endorsed implementation of the Java servlet specification v2.3 and JavaServer Pages (JSP) specification v1.2. For ORview, Tomcat has been configured with its server.xml file to run as a service in Windows NT and to accept SSL connections on port 443, the default port for SSL. Tomcat's insecure default port 8080 has been disabled, plugging insecure access to the middle tier. Tomcat's internal security model uses the Java key store "keys", and it is here that the server certificate key pair resides. Configuration of Tomcat, or any other commercial application server in this way may be desirable for ORview. However, ORview is not confined to using

Tomcat. Several of the commercial application servers could act as more powerful servlet containers, e.g. Bea's WebLogic server or IBM's WebSphere, but these application servers may be relatively expensive programs costing \$5,000 or more. Tomcat should work well enough unless volume gets very high, in which case the investment to a commercial application server may be worthwhile.

ORview can use ImageServer Pro software from Corda Technologies Inc. to render and serve highly interactive graphics in its output, the anesthesia record. Functionally, all the text-based portions of the delivered HTML page are processed by the servlets in Tomcat, while the graphics are processed by ImageServer running on Windows NT server 811 as shown in Figure 8.

ImageServer is a pure Java application designed for high volume financial sites with requests for 30,000 to 50,000 images/hour, and is more than capable for the task. Also included are the PopChart Image Server Embedder (PCISE) Java classes from Corda Technologies Inc. which allow direct communication of ORview with the ImageServer, and Popchart.class Java class, which is an HTTP Redirection Adapter allowing images to be served back to the requesting page through Tomcat's Secure Sockets Layer (SSL).

The ORview web application, orview.war, includes the code and associated files to run ORview. At its core are three Java servlets and a collection of JSPs. The servlet classes are contained in a package called orview. ORview includes an XML configuration file called web.xml. The web application contains the following associated files as shown in the screen images 911 and 1011 of Figures 9 and 10. Packages associated with ORview in the "classes" directory include:

1. com.sybase.jdbc.\*;
2. com.corda.servlet.\*;
3. javax.\*; and
4. orview.\*.

Of these, com.sybase.jdbc.\*, com.corda.servlet.\*, and javax.\* are freely distributed Java packages and classes from Sun Inc., Sybase Inc. and Corda Inc. associated with their Java2, JConnect and ImageServer products respectively. Also included in ORview.war are some associated image files and the collection of JSPs which control user registration and other forms of simple user input.

ORview.war is packaged according to the WC3 specification for a web-application and contains files to run ORview on the application server environment detailed in the previous section.

ORview uses two configuration files, server.xml and web.xml. server.xml is the WC3 compliant XML server configuration file for the Tomcat application server. It specifies how Tomcat is to be configured to manage its ports, security, logs and realms as well as other core functions specific to the application server. Web.xml is the XML configuration file for ORview, and is compliant with the WC3 web-application specification. Web.xml serves the following functions:

1. Identifies servlets to Tomcat and sets initialization and servlet address mapping parameters;
2. Provides the security and Realm settings for the ORview application; and
3. Provides initialization parameters to the servlets.

As shown in Figure 11, an Orview Windows NT application server 1101 can use any Java DataBase Connectivity (JDBC) 2.0 compliant driver 1111 to connect to a Relational Database Management System (RDBMS) 1113 of an anesthesia information system. For the Saturn Anesthesia Information system, ORview is configured using web.xml to use the Sybase JConnect driver v 5.5 which has the feature of scrollable result set cursors, part of the JDBC 2.0 standard. The Sybase driver is freely distributable and is included in the ORview web application in the com.sybase.\* package. As discussed above, the application server can be configured to provide a java virtual machine 1117 within which Tomcat 1119 operates.

The organization of database connectivity in ORview is illustrated in Figure 11. The core Servlets in ORview use SQL query strings 1115 and a pooled connection object to access the database. ORview also uses one stored procedure and 3 functions on the database, which is done at installation using an initial SQL database call. The 4 resident SQL stored procedures and functions are:

1. TodaysCasesByUser (Stored Procedure);
2. GetPatientLocation (function);
3. GetGroupName(function); and
4. GetBreakReliefString(function).

ORview uses sophisticated image processing techniques to efficiently generate Shockwave FLASH (Macromedia Inc.) images 1209 in the web screens of the anesthesia record 1211 as illustrated in Figure 12. Image generation is managed by a

Java software package called ImageServer Pro 1213 from Corda Technologies Inc. The principle of its use is to pass a datastream and a graphic template to an image rendering engine. The image server renders the graphic as a Macromedia Shockwave FLASH vector image and holds it and a reference to it in cached memory 1207 until required. The reference to the cached image on the server is embedded in HyperText Markup Language (HTML) in the served page to the user, and when the Internet Browser parses the embedded image tag, it requests the referenced image from the image server which it then displays. After a fixed period, the image server flushes the cached images from memory.

ImageServer Pro is an extremely fast image processing system, capable of rendering and serving images for high volume websites such as the financial Internet portals. The core ImageServer is a Java application which accepts I/O requests on port 81. ORview uses two other features of ImageServer to enable the rapid production of secure images. These other features of ImageServer are :

1. The PCISEmbedder 1215 which is a set of Java classes imported into the core ORview servlets. Their function is to pass the data stream to the ImageServer 1213, set the image generation parameters, incorporate a graphic template binary file (Chart.bin) and generate the HTML for the embedded graphic with its reference to the cached image on the image server.
2. The HyperText Transfer Protocol (HTTP) Redirection Adapter is Java class (PopChart.class) which enables images to be redirected from ImageServer's Port 81 to the Secure Sockets Layer (SSL) 1217 on port 443. Unless this is done, a functional distinction exists between the security of text and images served by ORview. The redirection adapter ensures that both these data types are encrypted over the web, and that the management of this is done by Tomcat's SSL.

ImageServer Pro need not be on the same physical server, but should be accessible via a URL over the Internet. ImageServer Pro has extensive load-balancing capability and can be scaled up to meet virtually any demand for image generation. ImageServer Pro runs as a service within a Java Virtual Machine 1219 on a Windows NT machine 1221. The PCISEmbedder 1215 and PopChart.class 1223 are contained in the package com.corda.\*, and are imported into the ORview application. ImageServer Pro is licensed from Corda per server. Conceivably, a single

ImageServer/ ORview application server combination could manage the web page generation and graphics processing of multiple hospitals.

The functionality of ORview may be described with reference to the illustration of Figure 13. A log-in may be required for security purposes using a login screen 1301. The Choices Page 1311 acts as a portal to the ORview application. Using radio button choices or typing a user name, users are able to request the anesthesia schedule page 1315 by service, by location, a personalized schedule, or initialize a search for anesthesia records pages 1317 for a particular patient using a search page 1319. Either a search page 1319 or an anesthesia schedule page 1315 can be used to generate a list of anesthesia records 1321 for a particular patient, and the list of anesthesia records 1321 can be used to generate a desired anesthesia record 1317. The flow of a user-session may include the following features:

1. Links. For example, selecting "Cardiac" at the Choices screen and then hitting the "go" button requests the cardiac schedule for the current day and the next day, and a web page is served which shows the cardiac schedule in an active tabular format. The schedule pages contain embedded links, so hitting the link on a particular patient will initiate a search for all anesthetic records associated with that patient, which may include a current running record. A page is then served which shows the list of anesthetic records for a particular patient, again in an active tabular format. Following the links on this page enables the user to drill down to individual anesthetic records. The anesthetic record is displayed as a combination of tabular and interactive graphical elements.
2. Navigation throughout the application is by following the links embedded in the pages, or by using the Browser's Back and Forward buttons. Most of the navigation is managed by HTML 'get' actions using simple parameterized queries. This enables individual pages, for example a patient's anesthetic record, to be bookmarked without compromising patient confidentiality.
3. Autorefresh. ORview has the facility to enable autorefresh of served pages, so the Operating Room schedule pages and Anesthetic records will autorefresh at a user specified time interval to give the impression of a near real-time live view of these elements.

4. Session Management. ORview uses a Java session manager class to handle user sessions. BASIC authentication of the user with Username and Password is required before any clinical pages are viewable. The session manager ensures that this authentication is good for the duration of a single user session on their browser, or times out after 120 minutes, whichever is sooner.

As illustrated in Figure 14, the Choices Page 1311 for ORview enables the user to select distinct derivatives of information. For example, the following derivatives of information may be selected:

1. The anesthesia schedule by Division, Location or by "In Progress" cases using radio buttons. These are customizable selections by institution according to desired functionality. The "In Progress" option selects all currently running cases. The default date range is for cases from the current date until the next working day, including the spanning of weekends, so it is always possible to see the following working day's schedule using the system.
2. Underneath this is an edit box for selection of the schedule by provider. This initiates a search for all scheduled cases in the default date range where the inputted provider has been involved in the clinical staffing. It will show users the cases they have been involved with today, and their schedules for tomorrow or Monday, if that is the next working day. ORview does not yet anticipate Holidays.
3. The "Search Old Saturn Records" link initiates the search for all anesthetic records related to a patient.

As illustrated in Figure 15, the Search page 1319 can be used to find all anesthetic records associated with a particular Patient. The search is initiated by a user entering the Patient's medical record number (MRN), or unique patient identifier, which could be a Social Security Number (SSN), for example. The page then passes the MRN as a parameter to the servlet CasesByHxno, which performs a series of JDBC SQL queries on the database and returns an HTML page with the Anesthesia Record Results by patient on it. Other search modalities can be provided, such as searching by patient name, the use of wildcard characters and the use of search logic to search based on combinations of different types of identifying information and/or parts thereof.

As illustrated in Figure 16, the Anesthesia Record Search Results page 1321 can display the output of the servlet CasesByHxno (patient names have been removed for confidentiality purposes). The Anesthesia Record Search Results Page has been designed to be a primary method of navigating to a patient's individual anesthetic records and may be a necessary selection step because a patient may have multiple anesthetic encounters recorded in the system. As such, the page should display just enough information for the user to identify a particular anesthesia record that they may wish to drill down further to view. The input parameter string to the servlet can be obtained either from the search page or by following a link from the OR Schedule Page. The input parameter, for example, may have a format such as:

<https://152.3.70.74/orview/casesbyhxno?HXNO=CM0319>.

Moreover, the input parameter can be bookmarked to provide rapid access in the future. Features on the Anesthesia Record Search Results page can include:

1. An active tabular format. Each row represents an individual anesthetic record, and displays a link in the Case ID column to an individual anesthetic record. By selecting a particular case identification (CaseID), the particular Anesthesia Record can be obtained.
2. The other columns display patient demographic information relating to the previous anesthetic encounters, including the surgical procedure and the Attending Anesthesiologist assigned to a case.
3. The Anesthesia Record Search Results Page can also include alerts such as alerts noted during a preoperative screening or note by a health care provider from a previous surgical event. For example, an alert icon provided on the Search Results page can provide a link to more information regarding the alert.

As shown in Figure 17, the Operating Room Status Page 1315 or monitor is a display of the output of the servlet CasesByUser and can be called by accessing the selection choices of the Choices Page 1311. The format of this page is active and tabular, with each row representing an individual anesthetic case, with links to the anesthetic records of an individual patient. The set of cases displayed on this page corresponds to the selection criteria from the Choices page, and may represent all the cases for a particular hospital, the cases for one service, or just those of an individual user, for example.



This page can accomplish at least two goals. The Operating Room Status page 1315 can act as a static schedule for planning purposes, and as a status monitor for a group of operating rooms or staff. It can act as a status monitor because the data in the columns in the page can reflect real-time events entered by users into the anesthesia information system database, and this data can autorefresh on the WebPage at intervals to give the appearance of real time case status. The inclusion of active links, blinking elements and autorefreshed data can give this Page the impression and utility of an "Airport Monitor" for the operating rooms, displaying the status of a large number of real time events in an effective manner. Features of the Operating Room Status Page 1315 can include:

1. Cases can be sorted by Date, Operating Room and/or Scheduled Case Start time to give the page a standard format of schedules used in many operating room suites.
2. The Case Status column can display the current status of a case depending on the status flag in the database; Preop, In Progress, Complete, Cancelled or Archived. If the case Status is "In Progress", the column element in that row can Blink to highlight that the case is currently active. In this way the user gets an immediate view of the active cases in the Operating Room (OR) suite.
3. The OR Name column displays information about the patient's scheduled and current location based on machine replication settings in the database. The database flags data recorded on particular workstations for a case, so it is possible to track exactly where a patient is at a particular time. The string shown in this column can be of the following format:

Location A=>Location B.

This format signifies Scheduled Location => Current Location. As such this tool enables the user to track the current location of a patient, and the difference from the scheduled location. This can be a tremendously powerful feature for administrators. For example, the post-anesthesia care unit 'PACU' choice in the welcome page may select all cases which are currently active on PACU workstations so that the OR Name column displays the bed spaces in PACU which are currently occupied.

4. The Patient Name, other demographic and case procedure columns reflect these database items for a single case. The database can be populated with

this data using an HL7 interface from the Hospital Information System (HIS).

5. The Last Attending and Last User columns reflect the last Attending to sign in to a case and the last or current user of the case based on user login. These columns thus reflect who should be called to access the caregivers for a case.
6. The Last User column can also provide the feature of an active element looking for data entered by users to reflect their 'break' reliefs, i.e. coffee and lunch breaks as shown in segment 1801 of Figure 18. The servlet can also look for database events entered by users to indicate 'breaks' and if found, displays persistently the most recent event and time in the Last User column. In this way, an administrator can see at a glance who has been given 'break relief' in a suite of operating rooms. This can be a powerful feature for management of staff, as this may otherwise be a haphazard process involving multiple telephone calls to rooms.
7. The Milestone and Time columns display the last entered milestone event and the time it occurred. Milestone events are configured at installation to be those events entered by the clinical user which reflect the time course of a case. As the page autorefreshes, the user can see individual cases 'march' through their milestones, giving an immediate impression of the exact clinical status of the case. This again can be a powerful tool for 'at-a-glance' administration of an operating room suite. Milestones are steps of a surgery occurring in the operating room while the case status is "In Progress", and milestones can include (but are not limited to): patient arrival in preop holding; start of anesthesia care; patient leaves preop holding; patient arrives in OR; anesthesia induction; anesthesia ready; surgical incision; surgical timepoints; aortic crossclamp on; CPB on; aortic crossclamp off; CPB off; surgeon closing wound; end of surgery; anesthesia extubation; patient arrives in PACU (recovery area); end of anesthesia care; and discharge from PACU; or free text entered by a care provider.
8. The Operating Room Status Page can also include one or more alert icons. The alert icon can be used as a link to textual information relating to specific information for one of the patients scheduled for operation. An

alert icon, for example, can be used to indicate an allergy, an event in a previous operation, an outcome of a previous operation, or any other information that would be useful to know before performing an operation and/or administering anesthesia. More particularly, a preoperative screening can be performed prior to the scheduled operation, information obtained during the preoperative screening can be entered into a screening database, and alert icons can be generated based on information entered into the screening database. In the alternative, events and/or outcomes from anesthesia records of prior operations can be used to generate alert icons on the Operating Room Status Page.

Operations for generating the Operating Room Status Page at the application server for display at a client device are illustrated in Figure 19. The application server can initialize the servlet CasesByUser by request from a browser of a remote client device at block 1901; get user/group parameters at block 1903, and initialize a JDBC connection with a relational database of an anesthesia information system at block 1905. At block 1907, stored SQL procedures are run to retrieve data from the relational database of the anesthesia information system and to build tables of the data for the Status Page. The result set is opened at block 1909, and a table header is built in a row using HTML at blocks 1911 and 1912. For each case to be displayed by the status monitor at block 1913, the case data is retrieved at block 1915, and an HTML row is built at block 1916. Once HTML rows have been built for the header and for all rows, the output HTML is returned to the calling browser of the remote client at block 1917.

As shown in Figure 20, the Anesthesia Record Page 1317 can display a representation of an anesthetic record using tabular, columnar and interactive graphical formatting of the data. It is the result of the output of the servlet CasesByCaseid and is accessed by following a link from the Anesthetic Record Search Result Page.

An overall impression of this page can be that of a classic anesthesia record in the format to which anesthesia staff is universally familiar. Some compromises may have to be made due to the limitations of the HTML medium and for the sake of application speed, but the result can be remarkably effective.

A rearrangement has been made in the ordering of the major categories of data compared to the classical record. The case events 2001 are placed first after

demographics 2003, instead of the case drugs, and the case events section is followed by a graphical display 2005 of the recorded vital signs and event bar. The case drugs 2007 are moved lower in the display after the graphical display. The gases and fluids 2009 and Labs and perioperative totals 2011 can follow the case drugs. This rearrangement reflects a departure from the functionality of the classic anesthetic record, which is optimized for data entry, whereas the web is optimized for data viewing. Putting the case events near the top of the page makes the course of the anesthetic immediately apparent to the clinical user, without having to scroll down to the rest of the case. Because a major function of a web-based anesthesia record is the rapid lookup and evaluation of old records, this can be a worthwhile change. It also partitions the page into “event” and “data” halves, with the rest of the page below. Events being devoted to the display of automatic, graphical and technical data optimized for more detailed review. Alternatively, a conventional arrangement of the data can be used.

Another feature of the page is the use of a ‘newspaper column’ format to compact the data into a relatively short scrollable page, while maintaining readability. Because the ‘MULTICOL’ HTML command is specific only to Netscape, it was not used, so the columnar formatting in ORview is performed in the servlet using a combination of Java and HTML code.

Another feature of the page is its ability to display a “real-time” view of the anesthetic record by using its autorefresh feature. A record autorefreshing every minute is effectively a real time view of the anesthetic or PACU record, so that ORview can be used to remotely monitor live cases over the internet. In fact, the graphical representation of the monitored vital sign data is so much more effective than that of most anesthesia information systems, that clinical users may elect to use ORview as a supplement view of case *in the operating room as the case is running*, using their Anesthesia Information System only for data entry, for which it is optimized.

An Anesthesia Record Page according to embodiments of the present invention can include the following field features:

1. Customizable header by institution, configured using web.xml.
2. Customizable logo by institution, configured using web.xml. (shown here is the spinning Duke shield).

3. Case Demographics with automatically resizing fields and calculated values taken from the database.
4. Case staffing data drawn from the database.
5. Case diagnosis and procedure fields drawn from the database.
6. Case Events. Here a newspaper column format is used to display 2 columns of the events associated with the case. The Columns resize to match the quantity of data.
7. The Monitored Vital Sign Graphic. This feature of ORview is the output of the ImageServer software as described in a previous section. The PopChart Image Server Embedder (PCISE) inserts an HTML reference to an image at this point in the page, and the web browser loads the image. The image is of Macromedia Shockwave Flash format, a vector graphic format which has excellent printing, rapid rendering, small size and interactivity as some of its properties. To view the graphic, the web-browser uses the Shockwave Flash Plug-in, for which a download reference is included in the embedded HTML, and which generally is included by default in all current major Browser installations.

Anesthesia records traditionally chart vital sign data graphically, and this feature of ORview does the same. It charts all the vital signs for a case in an image of 975 x 600 pixels. A significant feature of the graph is the custom 3D "Event Bar" **2101a** and **2101b** as shown in Figures 21 and 22. The 3D Event Bar is a representation of Events and Drugs in the perioperative record charted as a symbol **2103** against time at the point of the event. Multiple events in the same minute period are depicted by a vertical step in the y-axis, so that none of the symbols in a group are hidden by surrounding symbols. The third dimension to this feature is that the text events themselves are pop-up labels **2105** associated with the symbols, viewable by touching the symbols **2103** as a hot-spot, as shown in Figure 22.

In this way, ORview is able to represent a great deal of data in compact format, such that the entire record for a complex case can be squeezed into a graphic across a single screen and yet still allow the event and drug time course to be clear. This can be a great advantage of ORview over traditional Anesthesia Information Systems, which are generally optimized

for data entry and whose graphical representation of vital signs and drugs may often span several pages to the detriment of the overall view of the case. This is another reason why ORview may become preferred for reviewing anesthetic case data. The chart 2301 of Figure 23 illustrates this by showing how ORview represents the trended vital signs data from a 16 hour case.

8. The Drugs Display and Fluids Display follow the graphical data of Figure 20. Again, the newspaper column format is used to compact this information and display it in logical time sequence. Four columns are used for compactness, while retaining the aesthetic appeal of the page.
9. The Labs and Totals Display follows the Gases and Fluids Display of Figure 20. Three columns are used, but these are no longer newspaper columns as the data is of three different types. For drug and fluid totals, a simple descending list is used. For Labs, a complex list structure is displayed, with all the labs associated with a single time period concatenated into a string in a format very familiar to anesthesia staff.

Operations for generating an anesthesia record page at an application server for display at a remote client device are illustrated in Figure 24. The application server can initialize the servlet CasesByCaseID in response to a request from a browser of an authorized client device at block 2401. The CaseID parameters can be obtained at block 2403, and the JDBC connection with the database server of the anesthesia information system can be initialized at block 2405. The case demographics, case staff, case procedures, and case events can be obtained from the AIS database server at blocks 2407, 2409, 2411, and 2413, and organized into scrollable results sets at block 2415. The demographics and Events columns are built in an HTML format as shown at blocks 2417 and 2419. Vital signs are requested and retrieved at blocks 2423 and 2425, and loaded into the PCISEmedder at block 2427. The PCIS script including the vital signs is built using the image server to provide an embedded HTML image reference as shown at blocks 2429, 2431, and 2433. Totals for drugs, gases and fluids, and labs and perioperative are obtained at blocks 2435 and 2437, and a scrollable result set is built according to the HTML format as illustrated at blocks 2439 and 2441. The HTML output for the completed anesthesia record page is returned to the browser of the requesting client device.

Security and the maintenance of patient confidentiality can be an element of ORview. The security features of ORview can include up to three or more components:-

1. Strong Data Encryption;
2. User Authentication; and
3. User Audit.

Data encryption features of ORview have been extensively discussed elsewhere in this document, but to recap these features may include RSA\_5 strong public key/private key data encryption using the Secure Sockets Layer (SSL), used extensively for privacy on the Internet. Effectively, hacking or sniffing patient data between its source, the Tomcat application server, and the client Internet browser may be difficult or impossible.

These features, however, may not address a vulnerability between the application server and the database over the Tabular Data Stream (TDS) used by JDBC type 4 connections. This is moderately indecipherable, but can be read. However, in an individual hospital the application server and database server can be on the same intranet, so the TDS datastream can be no more vulnerable than any other text-based messaging system carrying patient data, such as HL7. The TDS vulnerability may become important if ORview is configured to access a remote database. For this situation, strong encrypted JDBC solutions exist, using JDBC type 3 drivers which utilize a middle tier datasource on the server and which encrypts the JDBC data interchange. A solution may be offered by IDS as discussed at <http://www.idsoftware.com/jdbcdrv.html>.

ORview can be configured for encrypted JDBC in the circumstance of serving schedules and anesthetic records to multiple hospitals over the Internet, and accessing multiple remote databases. A block diagram 2501 of security structures according to embodiments of the present invention are illustrated, for example, in Figure 25.

ORview can use the BASIC authentication (user/password) schema, administered using Tomcat's security realm model. This authentication can involve setting up a database of users with the data model illustrated in Figure 26.

The user realm for ORview is maintained in a separate Sybase Adaptive Server Anywhere database which manages the user rights to a single hospital's users. The settings for the realm are made on Tomcat's server.xml file. Multiple realms are possible for ORview, governing multiple different hospitals' security models.

The modus operandi of BASIC authentication is a password challenge, as shown in the screen **2701** of Figure 27. However, Tomcat may not provide a way of administering user names and passwords, so this mechanism can be built-in to ORview.

Users can be assigned a username and password upon request by the system administrator. This effectively creates a user\_name, user\_password, and user\_role in the user database. Users are assigned a starter password like "welcome" and then asked to change it on first login.

ORview provides a "Change Password Page" **2801** as shown in Figure 28 which enables the user to change their password in a valid manner. The output of this page is sent to a servlet, orview.changepswd which administers and updates the fields in the user database. Successful attempts to change password lead the user back to the main Welcome Page of ORview. Unsuccessful attempts to change a password are met with an error message, and the requirement to try again.

For any clinical application to maintain HIPPA compliance, it must have some mechanism of user audit. The very strengths of ORview's ability to make all patient data viewable on the Internet, may also be a considerable security weakness if users with appropriate access rights are using or viewing data inappropriately. This is called "peeking", and would include, for example, a colleague looking up a girlfriend's anesthesia record without her consent. The security principle here is that users should only have access to records and data from patients with whom they have a clinical relationship. However, this may be difficult or impossible to administer rigidly, as often caregivers will appropriately want to look up information on patients before they have actually created any record of the event in any hospital system.

One commonly used fallback method is to audit who is looking at what, and reprimand users whose use patterns are inappropriate. ORview uses this method, keeping an audit table of all database access of the anesthesia record in the table "audit\_user", with a schema as shown in Figure 29.

The onus then becomes one of auditing the audit table. However, statistical analysis of the audit table should rapidly show any inappropriate use, whilst providing an audit trail of individual accesses.

Embodiments of the invention can also use sophisticated user management schemas to organize registration and passwords. The diagram of Figure 30 illustrates the password schema of ORview, which makes extensive use of Java Server Pages



(JSP) technology. A new user can be assigned a temporary user name and password, and the temporary user name and password can be provided by the system administrator via e-mail. At the login page **3001**, the user enters the appropriate username and password, either permanent if an existing user or temporary if a new user. At block **3003**, the application server determines if the username and password are authorized as an existing user, normal system access is allowed by providing the Choices Page **3005**. If the username and password are authorized as a new user, a registration process is initiated at block **3007**. If the registration process is successfully completed at block **3009**, a permanent username and password are assigned to the new user at block **3011**, the permanent username and password are stored in the SQL user database **3013**, and the user can be prompted to login with the permanent password at **3001**.

Figure 30 also shows that the Choices Page can be used to initiate a change of password for an existing user. If a password change is requested at the Choices Page **3005**, the password change procedure can be performed at block **3015**. In particular, the user can select a new password, the new password can be saved in the SQL user database, and the user can be presented with the login request **3001** to login with the new password.

As described above, embodiments of the invention can exploit the power of the Internet in the perioperative environment. Embodiments of the invention can include, among other things, one or more of the following:

1. A Live Web-Based operating room and perioperative suite Status Monitor, that can be served robustly using data encryption and thereby opening the medium of the Internet to this practical clinical use.
2. A Perioperative Anesthetic Record viewable using an Internet Browser that can be served robustly using data encryption thereby opening the medium of the Internet to this practical clinical use.
3. The Representation of Monitored Data as a Graphic over the Internet that can be served robustly using an image server and also encrypted.
4. The representation of the Time course of Events and Drugs using a "3D event bar."
5. The use of middle tier, Java servlet and JavaServer Pages technology running on an Application Server to generate an Anesthetic Record and Perioperative Schedule.

Moreover, various terms used in this disclosure are further defined as indicated below:

1. Anesthesia Information Systems (AIS) are computer systems which record and display data gathered in the perioperative period. Data is either input by anesthesia, clerical or nursing staff directly into the system, or is automatically acquired from patient monitoring devices.
2. The perioperative period is the interval of time associated with a single surgical encounter, from the time of the decision to take a patient to surgery until the discharge of the patient home from hospital. This definition could also include outcome data gathered from the patient after discharge with respect to the associated surgical encounter.
3. JDBC is the abbreviation for Java Data Base Connectivity. A JDBC driver is a set of Java classes that manage connectivity to a database. ORview uses the Sybase JConnect driver, but is configurable to use any JDBC driver to any JDBC 2.0 enabled database (all the main RDBMs)
4. CDR is the abbreviation for Common Data Repository, a hospital database that aspires to collect all patient related data. A CDR is usually heavily interfaced to other hospital information systems, which send it their data. Usually this consists of lab tests, clinic notes, EKG reports and the like. A CDR usually has an associated front-end "browser" application which acts as a patient-centric window on the data.

In overview, embodiments of the present invention relate to providing scheduling information and/or medical records relating to surgical care. As will be appreciated by one of skill in the art, the present invention may be embodied as methods, data processing systems, and/or computer program products. Accordingly, the present invention may take the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment combining software and hardware aspects. Furthermore, the present invention may take the form of a computer program product on a computer-usable storage medium having computer-usable program code embodied in the medium. Any suitable computer readable medium may be utilized including, but not limited to, hard disks, CD-ROMs, optical storage devices, and magnetic storage devices.

Computer program code for carrying out operations of the present invention may be written in an object oriented programming language such as JAVA®,

Smalltalk or C++. The computer program code for carrying out operations of the present invention may also be written in conventional procedural programming languages, such as "C", or in various other programming languages. Software embodiments of the present invention do not depend on implementation with a particular programming language. In addition, portions of program code may execute entirely on one or more data processing systems.

The present invention is preferably practiced within a client/server programming environment. As is known by those skilled in this art, client/server is a model for a relationship between two computer programs in which one program, the client program, makes a service request from another program, the server program, which fulfills the request. Relative to the Internet, a Web browser is a client program that requests services (the sending of Web pages or files) from a Web server (which technically is called a Hypertext Transport Protocol or HTTP server) in another computer somewhere on the Internet.

An implementation of the present invention may use the Application Service Provider (ASP) model. As is understood by those of skill in the art, an ASP is an entity that offers individuals and enterprises access over the Internet (or other communications network) to applications and related services that would otherwise have to be located in local computers and/or devices.

As is known to those with skill in this art, client/server environments may include public communications networks, such as the Internet, and private communications networks often referred to as "intranets" and "extranets." The term "Internet" shall incorporate the terms "intranet" and "extranet" and any references to the Internet shall be understood to mean a communications network of any type, including intranets and/or extranets.

Further embodiments of the present invention will now be discussed with regard to the flow charts of Figures 31-35. Embodiments of the present invention, for example, can be used to provide a status monitor for a suite of operating rooms according to the operations illustrated in Figure 31 to provide a status monitor display such as that illustrated in Figure 17. As shown in Figure 31, operation scheduling information can be retrieved at block 3101. More particularly, the operation scheduling information can be retrieved for scheduled operations in a plurality of operating rooms in a designated hospital area over a predetermined time period, and the scheduling information can include a patient identification and a procedure

identification. For example, operation scheduling information can be retrieved for operations scheduled in one or more of a plurality of areas such as those areas identified in Figure 14 for a particular day. The scheduling information can thus provide information for fields of the columns of Figure 17 labeled "Division", "Date", "Pt Name" (patient name), "PtHxNo" (patient history number), "Age", and/or "Procedure". The scheduling information can be retrieved from a scheduling database.

At block 3103, current status information can be retrieved for scheduled operations while scheduled operations are in progress, and the current status information can be selected from one of a plurality of milestones of a surgical operation. The current status information can thus provide information for the fields of column of Figure 17 labeled "Milestones". By retrieving current status information while operations are in progress, a status monitor can provide near real-time information. Moreover, the current status information can be retrieved from data entered into electronic data entry systems in the respective operating rooms. The current status information, for example, can be retrieved from data entered into anesthesia information system workstations.

A table of scheduled operations over the predetermined time period can be built at block 3105. For each scheduled operation, the table can include respective patient and procedure identifications. The patient identification, for example, can be a patient name and/or a patient history number shown in Figure 17 as the columns labeled "Pt Name" and "PtHxNo". The table can also include the current status information such as the information shown in the column of Figure 17 labeled "Milestones" and times the respective "Milestones" were entered. The information of the table can be displayed at block 3107.

Scheduling information can thus be entered into an electronic scheduling system such that no additional scheduling information is entered for a particular day after some cut off time before the first scheduled operation that day. For example, the cut off time may be defined as being some time before the end of working hours the previous business day. Accordingly, the schedule for a given day can be set after the cut off the day before. The previously entered scheduling information can then be used as a base of information for the operating room status monitor during the day. This scheduling information can then be updated during the day in near real-time with data entered by surgical staff during surgery into workstations in the operating rooms

so that the status monitor can be used to manage a plurality of operating rooms in near real-time. Current status information, for example, may be updated once a minute.

As long as operations are continued at block 3109, the status monitor can maintain the display. When it is time to refresh the table and display with new current status information at block 3111, any new current status information can be retrieved at block 3103. The table can be rebuilt including any new current status information at block 3105, and the updated table can be displayed at block 3107. Refresh can be initiated at block 3111 periodically, such as at one minute intervals, and the refresh interval can be programmed by a user. Alternately, refresh can be initiated at block 3111 when it is detected that new current status information is available. In addition, refresh can be initiated at block 3111 in response to a user request for refresh.

As discussed above, a plurality of operating rooms can be equipped with a respective electronic data entry system wherein retrieving current status information can include retrieving current status information entered into the respective electronic data entry system. More particularly, one or more of the data entry systems can be an anesthesia information system workstation. In addition to operating rooms, the hospital area can also include a plurality of preoperative preparation areas and postoperative recovery areas and wherein the operating rooms, preoperative preparation areas, and postoperative recovery areas is equipped with a respective electronic data entry system. Accordingly, retrieving current status information at block 3103 can include retrieving current status information entered into the respective electronic data entry system in one or more of the operating rooms, preoperative preparation areas, and/or postoperative recovery areas.

The scheduling information retrieved at block 3101 and the table for each of the scheduled operations can also include at least one of an operating room identification (can be displayed under "OR Name" in Figure 17), a scheduled start time (can be displayed under "Case Status" in Figure 17), an assigned physician (can be displayed under "Last Attending" and/or "Last User" of Figure 17), and a patient age (can be displayed under "Age" in Figure 17). In addition, the patient identification for each scheduled operation can include at least one of a patient name (can be displayed under "Pt Name" in Figure 17) and a patient identification number (can be displayed under "PHxNo" in Figure 17). Moreover, the current status information retrieved at block 3103 can include a surgical event (can be displayed

under "Milestone" in Figure 17) and a time of the surgical event (can be displayed under "Time" in Figure 17).

The status monitor of Figures 17 and 31 can be used by a physician to obtain additional information regarding a surgical operation scheduled to be performed. For example, selection of a patient identification from the table of scheduled operations can be accepted. The selection of a patient identification, for example, can be entered by a user using a mouse or roller ball coupled with a screen displaying the table of scheduled operations, using a touch sensitive surface of the screen displaying the table of scheduled operations, a keypad, or other input means known to those having skill in the art.

Responsive to accepting selection of the patient identification, at least one case identification corresponding to the patient identification can be retrieved and displayed, as shown, for example, in Figure 16. In this context, a case identification can be a unique identification of a surgical operation performed, so that a different case identification is assigned to every surgical operation performed in a hospital, and so that a patient may have multiple case numbers associated therewith if multiple surgical operations have been performed in that hospital on that patient. In other words, a patient identification (such as "PtHxNo" of Figure 17 and/or "HxNo" of Figure 16) uniquely identifies the patient, and the case identification (such as "Case ID" of Figure 16) uniquely identifies each of the surgical operations.

As shown in Figure 16, selection of one patient identification from a displayed table of scheduled operations (such as that shown in Figure 17) may result in retrieving and displaying a plurality of case identifications (such as that illustrated in Figure 16). Selection of one of the plurality of case identifications can then be accepted from a user. As discussed above, user input can be provided using a mouse and/or roller ball coupled with a screen displaying the plurality of case identifications, using a touch sensitive surface of a screen displaying the plurality of case identifications, or using other input means known to those having skill in the art.

Responsive to accepting selection of the case identification, a medical record corresponding to the selected case identification for the selected patient identification can be retrieved and displayed. Retrieving the medical record can include retrieving data making up the medical record from a relational database and building a file of data for the medical record as opposed to retrieving a scanned image of a record. More particularly, the medical record can be an anesthesia record, and the anesthesia

record can include a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation. Moreover, the anesthesia can have the format and additional information illustrated in Figure 20.

Additional embodiments of the present invention, for example, can be used to retrieve medical information in an efficient manner according to operations illustrated in Figure 32 to provide case identifications such as illustrated in Figure 16. For example, scheduling information can be retrieved for all scheduled operations meeting predefined criteria at block 3201, wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification. The patient identification can include at least one of a patient name and a patient identification number, and the scheduling information can additionally include at least one of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

A table of all scheduled operations can be built at block 3203, wherein for a respective scheduled operation, the table includes the respective patient identification and procedure identification, and the table can be displayed at block 3205. The predefined criteria, for example, can be defined by the user as all operations scheduled for a particular physician on a given day. Accordingly, the table and display can include information such as that illustrated in Figure 17 but only for cases scheduled for the selected physician. Alternately, the predetermined criteria can be defined by the user as all operations scheduled for a particular area of the hospital on a given day. Moreover, other criteria and/or other time periods may be used.

The display can be maintained at block 3207 until a user selection is made. Selection of one of the patient identifications can be accepted from the table of all scheduled operations meeting the predefined criteria at block 3209, and responsive to accepting selection of the patient identification, at least one case identification corresponding to the patient identification can be retrieved at block 3211. User selection can be input through a mouse or roller ball coupled to a screen displaying the table, through a touch sensitive surface of a screen displaying the table, or through other means known to those having skill in the art. The at least one case identification corresponding to the patient identification can then be displayed at block 3213 to provide a display such as that illustrated in Figure 16. As discussed above, each case identification identifies a different surgical operation performed on the patient.

Embodiments of the present invention can thus allow a physician to efficiently generate a schedule of the physician's assigned operations for a defined time period, and then generate a list of previous operations for a patient listed on the schedule. The list of previous operations may be useful to the physician in preparing for a particular operation.

Once case identifications are displayed for a patient, embodiments of the present invention allow the physician to obtain medical records such as anesthesia records for the different previously performed operations. Information included in these medical records may be useful in preparation for the scheduled operation. For example, table of case identifications can be maintained at block 3215 until a user selection of a case identification is made. Selection of one of the case identifications can be accepted and a medical record corresponding to the selected case identification for the selected patient identification can be retrieved at block 3217 and displayed at block 3219. More particularly, the medical record can be an anesthesia record, and the anesthesia record can include a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

The medical record may be displayed until there is user selection at block 3221 of the previously displayed case identifications. If the user selects to return to the previously displayed case identifications, the case identifications can be displayed at block 3213, and the user can select a different one of the case identifications at block 3215 for retrieval and display of a new medical record at blocks 3217 and 3219. Accordingly, a physician can efficiently view different medical records for a patient in preparation for an operation.

Alternately, the user may select at block 3223 to return to the previously displayed table of scheduled operations at block 3205. A selection and acceptance of a new patient identification from the previously generated table can thus be made at blocks 3207 and 3209, and new case identifications corresponding to the new patient identification can be retrieved and displayed at blocks 3211 and 3213. Medical records corresponding to the new case identifications can be selected, retrieved, and displayed as discussed above with respect to blocks 3215, 3217, 3219, and 3221. Accordingly, a physician can efficiently review medical records from prior operations for different patients scheduled for different operations.



In addition, a user can select new schedule criteria at block 3225 so that different scheduling information is retrieved at block 3201. A physician, for example, may first retrieve scheduling information for the next day as discussed above. After reviewing the schedule, prior related case identifications, and prior related medical records, the physician may choose at block 3225 to retrieve scheduling information for another day. Moreover, a supervising physician may choose to generated different schedules for the same day for different physicians be supervised.

When retrieving information according to embodiments of the present invention, alerts from pre-operative screenings corresponding to a patient identification included in the table of scheduled operations can also be retrieved. Moreover, these alerts can be included in and displayed with the table of scheduled operations meeting the predefined criteria. The displayed alert may be an alert icon providing a link to additional textual information. For example, a preoperative screening may be performed a week before the operation, and a particular allergy or other useful information may be uncovered at that time. This information may be entered into a preoperative screening database such that the step of retrieving scheduling information at block 3201 includes retrieving alerts from the preoperative screening database. Identification of and access to these alerts may further enhance the physician's ability to prepare for scheduled operations.

Additional embodiments of the present invention, for example, can be used to display anesthesia records according to operations illustrated in Figure 33 to provide an anesthesia record such as that illustrated in Figure 20. Moreover, the anesthesia records can be displayed using a data processing system at a terminal remote from the data processing system. For example, entry of information identifying a surgical operation can be accepted at block 3301 wherein the information is entered via a client device in communication with the data processing system. Anesthesia data corresponding to the identified surgical operation can be retrieved at block 3303, and an anesthesia record can be built at block 3305 using the retrieved anesthesia data. Secure communication of the anesthesia record to the client device can be provided at block 3307 for display of the anesthesia record at the client device.

More particularly, the anesthesia data can be retrieved from a database (such as a relational database) generated by an anesthesia information system including workstations in respective operating rooms for data input by surgical staff during operations. Each field of the anesthesia record to be built can be populated by

retrieving a corresponding field from the database. In other words, anesthesia record can be built by retrieving a plurality of data fields from a database. In addition, the database can be separate from the data processing system used to build the anesthesia record.

Moreover, the client device can be a terminal such as a personal computer remote from the data processing system wherein the client device and data processing system are coupled by a network such as the internet. By providing secure communication of the anesthesia record from the data processing system to the client device, the confidential anesthesia record can be obtained remotely over an unsecured network such as the internet. Moreover, the secure communication can be provided using encryption as discussed above.

The resulting anesthesia record can include a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation, and the anesthesia record can have a format such as that illustrated in Figure 20. Moreover, the anesthesia record can be built and communicated while the identified surgical operation is in progress. Accordingly, the progress of a surgical operation can be viewed at a client device remote from the operation while the operation is taking place in near real-time, for example, to provide consultation from a remote location. As shown in Figure 33, if there is updated information for the anesthesia record at block 3309, the updated data can be retrieved at block 3303, the anesthesia record can be built with the new data 3305, and the anesthesia record can be securely communicated at block 3307 for display of the updated anesthesia record at the client device. Updated information for the anesthesia record can be provided at block 3309, for example, at predetermined time intervals that can be designated by the user, such as once a minute. Alternately, updated information can be provided when updated information is made available or on user request. As further shown at block 3311 of Figure 33, a new anesthesia record may be selected such that operations of blocks 3301, 3303, 3305, and 3307 are repeated for the new anesthesia record.

The anesthesia record can include a graphical representation of events occurring during the identified surgical operation for display at the client device. The graphical representation can include a time line divided into predetermined units of time with a plurality of events occurring during a period of time represented by a single unit on the time line being represented by respective discreet and

distinguishable event icons as illustrated, for example, in Figures 21 and 22. In addition, user selection of one of the discrete and distinguishable icons can be accepted, and responsive to accepting selection of one of the discrete and distinguishable event icons, text identifying the event corresponding to the selected discrete event icon can be provided for display at the client device as illustrated, for example, in Figure 22.

Accepting entry of information identifying a surgical operation at block 3301 can include accepting entry of any information sufficient to identify the surgical operation. For example, entry of a patient identification such as a patient name or patient identification number may be used to identify the anesthesia record. Alternately or in addition, entry of a case identification may be used to identify the anesthesia record. Moreover, any of the operations discussed above with regard to Figure 32 may be used to identify a particular anesthesia record. Moreover, a boolean search may be used to identify a particular anesthesia record.

In addition, aspects of embodiments discussed above can be combined as illustrated, for example, in Figure 34. As discussed, a user can access medical information such as anesthesia records and/or surgical operation schedules using a remote client device coupled to an application server over a network such as the internet. To reduce the risk of unauthorized access, a log-in may be required by the application server at block 3401, so that access is only provided if an authorized combination of username and password are entered at the client device. Upon successful login, the application server can provide a choices page at block 3403 for display at the client device. A choices page such as that illustrated in Figure 14 can be used providing a choice of a search of anesthesia records or a choice of schedules for different hospital areas or physicians. Other choices may also be provided. If the user selects searches at block 3407, the application server can proceed to accept user input of search criteria at block 3421. Alternately, if the user selects schedules at block 3407, the application server can proceed to accept user input of schedule criteria at block 3441.

Upon accepting user input of search criteria at block 3421, the application server can generate a list of anesthesia records matching the search criteria at block 3423 for display at the client device. The list of anesthesia records can be generated and displayed, for example, using the format of Figure 16 wherein a case identification ("Case ID") identifies each of the anesthesia records. The user may

then select one of the anesthesia records, and on accepting the user selection at block 3425, the anesthesia record can be generated at block 3471. Otherwise, the user may elect a new search at block 3427, or the user may elect to go back to the choices page at block 3429.

Generation of the anesthesia record at block 3471 can be performed as discussed above with respect to Figure 33. Once a record has been generated and displayed, the user may elect to go back to the previously generated list of anesthesia records and select another anesthesia record for display. At block 3473, the user may elect to go back to the previously generated list of anesthesia records at block 3423. Another record may be selected at block 3425, a new search may be selected at block 3427, or the user can select at block 3429 to go back to the choices page at block 3403.

If the user selects schedules at block 3407, the application server can proceed with accepting user input of schedule criteria. Moreover, the selection of scheduling and the particular scheduling criteria may be provide in a single operation such as illustrated in the Choices Page of Figure 14. A schedule is then generated based on the schedule criteria at block 3443 for display at the client device. The schedule can be generated and displayed according to the format illustrated in Figure 17. Moreover, the operation of generating a schedule of block 3443 can be the same as that discussed above with regard to the operations of Figure 31. The user can then select a patient identification from the displayed schedule at block 3445, and a list of anesthesia records can be generated for display at the client device according to a format such as that illustrated in Figure 16.

If one of the records for the patient is selected by the user at block 3447, the anesthesia record can be generated at block 3471 for display at the client device according to a format such as that illustrated in Figure 20. If a patient is not selected at block 3445, the user may elect at block 3453 a new schedule based on new criteria to be input at block 3441, or the user may elect at block 3455 to go back to the choices page at block 3403. If an anesthesia record is not selected at block 3447, the user may elect at block 3449 selection of a new patient from the schedule, selection of new schedule criteria at block 3451, or at block 3455 to return to the choices page. Once an anesthesia record is generated at block 3473 responsive to user selection of information from a schedule, the user may elect at block 3473 generation of the schedule at block 3443 for display on the client device. The user can then select the

same or a different patient and/or record. The operations of blocks 3443, 3445, and 3447, and 3471 can be the same as operations discussed above in greater detail with regard to Figure 32.

The operations of Figures 31-34 can be performed by an application server 3501 in communication with a client device 3503 over a network 3505 such as the internet. User input can be provided through the client device 3503 and network 3505 to the application server 3501. User input can be provided using a touch sensitive screen of the client device, using a mouse or roller ball coupled with the client device, using a keyboard at the client device, and/or using other means known to those having skill in the art. In addition, the application server 3501 can obtain data from database servers of one or more information systems such as an anesthesia information system 3507, a hospital scheduling system 3509, and/or a preoperative screening system 3511. Data used to build an anesthesia record, for example, can be obtained from a database server of anesthesia information system 3507 including anesthesia workstations in operating rooms. Data used to build schedules can be obtained from a database server of hospital scheduling system 3509, and data used to provide alerts can be obtained from a database server of a preoperative screening system 3511.

Methods, systems, and computer program products according to embodiments of the present invention can thus be implemented separate from other hospital information systems such that only a data connection to the other hospital information systems is required. In the alternative, methods, systems, and computer program products according to embodiments of the present invention can be integrated in whole or in part with one or more hospital systems. For example, methods, systems, and computer program products according to embodiments of the present invention can be integrated in whole or in part with an anesthesia information system such as the Saturn Information System produced by Draeger.

Moreover, embodiments of the present invention have been discussed, by way of example, with reference to anesthesia records. Embodiments of the present invention, however, may be applied to other medical records. For example, embodiments of the present invention may be used with Intensive Care Unit (ICU) records.

The foregoing is illustrative of embodiments of the present invention and is not to be construed as limiting thereof. Although a few exemplary embodiments of this invention have been described, those skilled in the art will readily appreciate that

many modifications are possible in the exemplary embodiments without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the claims. Therefore, it is to be understood that the foregoing is illustrative of the present invention and is not to be construed as limited to the specific embodiments disclosed, and that modifications to the disclosed embodiments, as well as other embodiments, are intended to be included within the scope of the appended claims. The invention is defined by the following claims, with equivalents of the claims to be included therein.

That Which Is Claimed Is:

1. A method of displaying operation scheduling information for a hospital surgical area including a plurality of operating rooms, the method comprising:

retrieving scheduling information for scheduled operations in the plurality of operating rooms of the hospital area over a predetermined time period wherein the scheduling information for respective scheduled operations includes a patient identification and a procedure identification;

retrieving current status information for at least one of the scheduled operations while in progress wherein the current status information is selected from a plurality of milestones of a surgical operation while in progress; and

providing a table of scheduled operations over the predetermined time period for display at a client device, wherein for respective scheduled operations, the table includes the respective patient identification and procedure identification wherein the table further includes the current status information.

2. A method according to Claim 1 wherein respective ones of the plurality of operating rooms are equipped with a respective electronic data entry system wherein retrieving current status information comprises retrieving current status information entered into a respective electronic data entry system.

3. A method according to Claim 2 wherein at least one of the data entry systems comprises an anesthesia information system workstation.

4. A method according to Claim 1 wherein the hospital area further includes a plurality of preoperative preparation areas and postoperative recovery areas and wherein the operating rooms, preoperative preparation areas, and postoperative recovery areas are equipped with respective electronic data entry systems, and wherein retrieving current status information comprises retrieving current status information entered into a respective electronic data entry system.

5. A method according to Claim 1 wherein retrieving current status information comprises retrieving current status information at regular intervals, the method further comprising:

refreshing the table on receipt of new current status information and displaying the refreshed table.

6.A method according to Claim 1 wherein the scheduling information and the table for each of the scheduled operations further includes at least one selected from the group consisting of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

7.A method according to Claim 1 wherein the patient identification for a scheduled operation includes at least one selected from the group consisting of a patient name and a patient identification number.

8.A method according to Claim 1 the current status information includes a surgical event and a time of the surgical event.

9.A method according to Claim 1 further comprising:

accepting selection of a patient identification from the table of scheduled operations;

responsive to accepting selection of the patient identification, retrieving at least one case identification corresponding to the patient identification; and

displaying the at least one case identification corresponding to the patient identification.

10.A method according to Claim 9 wherein the at least one case identification comprises a plurality of case identifications, the method further comprising:

accepting selection of one of the case identifications;

responsive to accepting selection of the case identification, retrieving a medical record corresponding to the selected case identification for the selected patient identification; and

displaying the medical record.

11.A method according to Claim 10 wherein the medical record comprises an anesthesia record.



12.A method according to Claim 11 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

13.A method of retrieving medical information comprising:  
retrieving scheduling information for scheduled operations meeting a predefined criteria wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification;  
providing a table of scheduled operations meeting the predefined criteria for display at a client device wherein for each scheduled operation, the table includes the respective patient identification and procedure identification;  
accepting selection of one of the patient identifications from the table of scheduled operations meeting the predefined criteria; and  
responsive to accepting selection of the patient identification, retrieving at least one case identification corresponding to the patient identification for display at the client device.

14.A method according to Claim 13 wherein the at least one case identification comprises a plurality of case identifications, the method further comprising:  
accepting selection of one of the case identifications; and  
responsive to accepting selection of the case identification, retrieving a medical record corresponding to the selected case identification for the selected patient identification for display at the client device.

15.A method according to Claim 14 wherein the medical record comprises an anesthesia record.

16.A method according to Claim 15 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

17.A method according to Claim 13 wherein retrieving scheduling information for scheduled operations meeting a predefined criteria comprises retrieving scheduling information for operations scheduled within a predetermined time period for an area of a hospital.

18.A method according to Claim 13 wherein retrieving scheduling information for scheduled operations meeting a predefined criteria comprises retrieving scheduling information for operations scheduled with a designated physician within a predetermined time period.

19.A method according to Claim 13 wherein the scheduling information and the table for each of the scheduled operations further includes at least one selected from the group consisting of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

20.A method according to Claim 13 wherein the patient identification for each scheduled operation includes at least one selected from the group consisting of a patient name and a patient identification number.

21.A method according to Claim 13 further comprising:  
retrieving an alert from a pre-operative screening corresponding to a patient identification included in the table of scheduled operations meeting the predefined criteria, wherein displaying the table of scheduled operations meeting the predefined criteria includes displaying an indication of the alert.

22.A method of displaying anesthesia records comprising the following performed by a data processing system:  
accepting entry of information identifying a surgical operation wherein the information is entered via a client device in communication with the data processing system;  
retrieving anesthesia data corresponding to the identified surgical operation;  
building an anesthesia record using the retrieved anesthesia data; and  
providing secure communication of the anesthesia record to the client device for display of the anesthesia record at the client device.

23. A method according to Claim 22 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

24. A method according to Claim 23 wherein providing secure communication of the anesthesia record comprises providing secure communication of the anesthesia record corresponding to the identified surgical operation while the identified surgical operation is in progress.

25. A method according to Claim 24 further comprising:

after providing secure communication of the anesthesia record to the client device, retrieving updated information including at least one selected from the group consisting of a new event occurring during the surgical operation, a new measurement of vital signs, and a new drug administered; and

after retrieving the updated information, providing secure communication of the updated information to the client device for display of an update of the anesthesia record at the client device while the identified surgical operation is in progress.

26. A method according to Claim 22 wherein the anesthesia record comprises a graphical representation of events occurring during the identified surgical operation for display at the client device, the graphical representation including a time line divided into predetermined units of time with a plurality of events occurring during a period of time represented by a single unit on the time line being represented by respective discreet and distinguishable event icons.

27. A method according to Claim 26 further comprising:

accepting selection of one of the discreet and distinguishable event icons; and responsive to accepting selection of one of the discreet and distinguishable event icons, providing text identifying the event corresponding to the selected discreet and distinguishable event icon for display at the client device.

28.A method according to Claim 22 wherein accepting entry of information identifying a surgical operation comprises accepting entry of a selection of a patient identification.

29.A method according to Claim 28 wherein the patient identification includes at least one selected from the group consisting of a patient name, and a patient identification number.

30.A method according to Claim 22 wherein accepting entry of information identifying a surgical operation comprises accepting entry of a selection of a case identification.

31.A data processing system that facilitates display of operation scheduling information for a hospital surgical area including a plurality of operating rooms, the data processing system comprising:

means for retrieving scheduling information for scheduled operations in the plurality of operating rooms of the hospital area over a predetermined time period wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification;

means for retrieving current status information for at least one of the scheduled operations while in progress wherein the current status information is selected from a plurality of milestones of a surgical operation while in progress; and

means for providing a table of scheduled operations over the predetermined time period for display at a client device wherein for a scheduled operation, the table includes the respective patient identification and procedure identification wherein the table further includes the current status information.

32.A data processing system according to Claim 31 wherein the plurality of operating rooms are equipped with a respective electronic data entry system wherein the means for retrieving current status information comprises means for retrieving current status information entered into the respective electronic data entry system.

33.A data processing system according to Claim 32 wherein at least one of the data entry systems comprises an anesthesia information system workstation.

34.A data processing system according to Claim 31 wherein the hospital area further includes a plurality of preoperative preparation areas and postoperative recovery areas and wherein the operating rooms, preoperative preparation areas, and postoperative recovery areas are equipped with respective electronic data entry systems, and wherein the means for retrieving current status information comprises means for retrieving current status information entered into the respective electronic data entry system.

35.A data processing system according to Claim 31 wherein the means for retrieving current status information comprises means for retrieving current status information at regular intervals, the data processing system further comprising:

means for refreshing the table on receipt of new current status information and means for providing the refreshed table for display at the client device.

36.A data processing system according to Claim 31 wherein the scheduling information and the table for the scheduled operations further includes at least one selected from the group consisting of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

37.A data processing system according to Claim 31 wherein the patient identification for a scheduled operation includes at least one selected from the group consisting of a patient name and a patient identification number.

38.A data processing system according to Claim 31 the current status information includes a surgical event and a time of the surgical event.

39.A data processing system according to Claim 31 further comprising:

means for accepting selection of a patient identification from the table of scheduled operations;

means, responsive to accepting selection of the patient identification, for retrieving at least one case identification corresponding to the patient identification; and

means for providing the at least one case identification corresponding to the patient identification for display at the client device.

40. A data processing system according to Claim 39 wherein the at least one case identification comprises a plurality of case identifications, the data processing system further comprising:

means for accepting selection of one of the case identifications;

means, responsive to accepting selection of the case identification, for retrieving a medical record corresponding to the selected case identification for the selected patient identification; and

means for providing the medical record for display at the client device.

41. A data processing system according to Claim 40 wherein the medical record comprises an anesthesia record.

42. A data processing system according to Claim 41 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

43. A data processing system that retrieves medical information comprising:

means for retrieving scheduling information for scheduled operations meeting a predefined criteria wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification;

means for providing a table of scheduled operations meeting the predefined criteria for display at a client device wherein for each scheduled operation, the table includes the respective patient identification and procedure identification;

means for accepting selection of one of the patient identifications from the table of scheduled operations meeting the predefined criteria; and

means, responsive to accepting selection of the patient identification, for retrieving at least one case identification corresponding to the patient identification for display at the client device.

44.A data processing system according to Claim 43 wherein the at least one case identification comprises a plurality of case identifications, the data processing system further comprising:

means for accepting selection of one of the case identifications; and

means, responsive to accepting selection of the case identification, for retrieving a medical record corresponding to the selected case identification for the selected patient identification for display at the client device.

45.A data processing system according to Claim 44 wherein the medical record comprises an anesthesia record.

46.A data processing system according to Claim 45 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

47.A data processing system according to Claim 43 wherein the means for retrieving scheduling information for scheduled operations meeting a predefined criteria comprises means for retrieving scheduling information for operations scheduled within a predetermined time period for an area of a hospital.

48.A data processing system according to Claim 43 wherein the means for retrieving scheduling information for scheduled operations meeting a predefined criteria comprises means for retrieving scheduling information for operations scheduled with a designated physician within a predetermined time period.

49.A data processing system according to Claim 43 wherein the scheduling information and the table for each of the scheduled operations further includes at least one selected from the group consisting of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

50.A data processing system according to Claim 43 wherein the patient identification for each scheduled operation includes at least one selected from the group consisting of a patient name and a patient identification number.

51.A data processing system according to Claim 43 further comprising:

means for retrieving an alert from a pre-operative screening corresponding to a patient identification included in the table of scheduled operations meeting the predefined criteria, wherein providing the table of scheduled operations meeting the predefined criteria includes providing an indication of the alert.

52.A data processing system that displays anesthesia records comprising:

means for accepting entry of information identifying a surgical operation wherein the information is entered via a client device in communication with the data processing system;

means for retrieving anesthesia data corresponding to the identified surgical operation;

means for building an anesthesia record using the retrieved anesthesia data; and

means for providing secure communication of the anesthesia record to the client device for display of the anesthesia record at the client device.

53.A data processing system according to Claim 52 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

54.A data processing system according to Claim 53 wherein the means for providing secure communication of the anesthesia record comprises means for providing secure communication of the anesthesia record corresponding to the identified surgical operation while the identified surgical operation is in progress.

55.A data processing system according to Claim 54 further comprising:

means for retrieving updated information after providing secure communication of the anesthesia record to the client device, the updated information including at least one selected from the group consisting of a new event occurring during the surgical operation, a new measurement of vital signs, and a new drug administered; and



means for providing secure communication of the updated information to the client device for display of an update of the anesthesia record at the client device while the identified surgical operation is in progress after retrieving the updated information.

56.A data processing system according to Claim 52 wherein the anesthesia record comprises a graphical representation of events occurring during the identified surgical operation for display at the client device, the graphical representation including a time line divided into predetermined units of time with a plurality of events occurring during a period of time represented by a single unit on the time line being represented by respective discreet and distinguishable event icons.

57.A data processing system according to Claim 56 further comprising:

means for accepting selection of one of the discreet and distinguishable event icons; and

means, responsive to accepting selection of one of the discreet and distinguishable event icons, for providing text identifying the event corresponding to the selected discreet and distinguishable event icon for display at the client device.

58.A data processing system according to Claim 52 wherein accepting entry of information identifying a surgical operation comprises accepting entry of a selection of a patient identification.

59.A data processing system according to Claim 58 wherein the patient identification includes at least one selected from the group consisting of a patient name, and a patient identification number.

60.A data processing system according to Claim 52 wherein the means for accepting entry of information identifying a surgical operation comprises means for accepting entry of a selection of a case identification.

61.A computer program product that displays operation scheduling information for a hospital surgical area including a plurality of operating rooms, the computer program product comprising a computer useable storage medium having

computer readable program code embodied in the medium, the computer readable program code comprising:

computer readable program code that retrieves scheduling information for scheduled operations in the plurality of operating rooms of the hospital area over a predetermined time period wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification;

computer readable program code that retrieves current status information for at least one of the scheduled operations while in progress wherein the current status information is selected from a plurality of milestones of a surgical operation while in progress; and

computer readable program code that provides a table of scheduled operations over the predetermined time period for display at a client device wherein for a scheduled operation, the table includes the respective patient identification and procedure identification wherein the table further includes the current status information.

62.A computer program product according to Claim 61 wherein the plurality of operating rooms is equipped with a respective electronic data entry system wherein the computer readable program code that retrieves current status information retrieves current status information entered into the respective electronic data entry system.

63.A computer program product according to Claim 62 wherein at least one of the data entry systems comprises an anesthesia information system workstation.

64.A computer program product according to Claim 61 wherein the hospital area further includes a plurality of preoperative preparation areas and postoperative recovery areas and wherein the operating rooms, preoperative preparation areas, and postoperative recovery areas are equipped with respective electronic data entry systems, and wherein the computer readable program code that retrieves current status information retrieves current status information entered into the respective electronic data entry system.

65. A computer program product according to Claim 61 wherein the computer readable program code that retrieves current status information retrieves current status information at regular intervals, the computer program product further comprising:

computer readable program code that refreshes the table on receipt of new current status information and that provides the refreshed table for display at the client device.

66. A computer program product according to Claim 61 wherein the scheduling information and the table for the scheduled operations further includes at least one selected from the group consisting of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

67. A computer program product according to Claim 61 wherein the patient identification for the scheduled operations includes at least one selected from the group consisting of a patient name and a patient identification number.

68. A computer program product according to Claim 61 the current status information includes a surgical event and a time of the surgical event.

69. A computer program product according to Claim 61 further comprising:

computer readable program code that accepts selection of a patient identification from the table of scheduled operations;

computer readable program code that retrieves at least one case identification corresponding to the patient identification responsive to accepting selection of the patient identification; and

computer readable program code that provides the at least one case identification corresponding to the patient identification for display at the client device.

70. A computer program product according to Claim 69 wherein the at least one case identification comprises a plurality of case identifications, the computer program product further comprising:

computer readable program code that accepts selection of one of the case identifications;

computer readable program code that retrieves a medical record corresponding to the selected case identification for the selected patient identification responsive to accepting selection of the case identification; and

computer readable program code that provides the medical record for display at the client device.

71.A computer program product according to Claim 70 wherein the medical record comprises an anesthesia record.

72.A computer program product according to Claim 71 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

73.A computer program product that retrieves medical information, the computer program product comprising a computer usable storage medium having computer readable program code embodied in the medium, the computer readable program code comprising:

computer readable program code that retrieves scheduling information for scheduled operations meeting a predefined criteria wherein the scheduling information for the scheduled operations includes a patient identification and a procedure identification;

computer readable program code that provides a table of scheduled operations meeting the predefined criteria for display at a client device wherein for each scheduled operation, the table includes the respective patient identification and procedure identification;

computer readable program code that accepts selection of one of the patient identifications from the table of scheduled operations meeting the predefined criteria;

computer readable program code that retrieves at least one case identification corresponding to the patient identification responsive to accepting selection of the patient identification for display at the client device.

74.A computer program product according to Claim 73 wherein the at least one case identification comprises a plurality of case identifications, the computer program product further comprising:

computer readable program code that accepts selection of one of the case identifications; and

computer readable program code that retrieves a medical record corresponding to the selected case identification for the selected patient identification responsive to accepting selection of the case identification for display at the client device.

75.A computer program product according to Claim 74 wherein the medical record comprises an anesthesia record.

76.A computer program product according to Claim 75 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

77.A computer program product according to Claim 73 wherein the computer readable program code that retrieves scheduling information for scheduled operations meeting a predefined criteria retrieves scheduling information for operations scheduled within a predetermined time period for an area of a hospital.

78.A computer program product according to Claim 73 wherein the computer readable program code that retrieves scheduling information for scheduled operations meeting a predefined criteria retrieves scheduling information for operations scheduled with a designated physician within a predetermined time period.

79.A computer program product according to Claim 73 wherein the scheduling information and the table for each of the scheduled operations further includes at least one selected from the group consisting of an operating room identification, a scheduled start time, an assigned physician, and a patient age.

80. A computer program product according to Claim 73 wherein the patient identification for each scheduled operation includes at least one selected from the group consisting of a patient name and a patient identification number.

81. A computer program product according to Claim 73 further comprising:  
computer readable program code that retrieves an alert from a pre-operative screening corresponding to a patient identification included in the table of scheduled operations meeting the predefined criteria, wherein displaying the table of scheduled operations meeting the predefined criteria includes displaying an indication of the alert.

82. A computer program product that displays anesthesia records, the computer program product comprising a computer usable storage medium having computer readable program code embodied in the medium, the computer readable program code comprising:

computer readable program code that accepts entry of information identifying a surgical operation wherein the information is entered via a client device in communication with the data processing system;

computer readable program code that retrieves anesthesia data corresponding to the identified surgical operation;

computer readable program code that builds an anesthesia record using the retrieved anesthesia data; and

computer readable program code that provides secure communication of the anesthesia record to the client device for display of the anesthesia record at the client device.

83. A computer program product according to Claim 82 wherein the anesthesia record comprises a date of a surgical operation, events occurring during the surgical operation, a graphical display of vital signs recorded during the surgical operation, and drugs administered during the surgical operation.

84. A computer program product according to Claim 83 wherein the computer readable program code that provides secure communication of the anesthesia record

provides secure communication of the anesthesia record corresponding to the identified surgical operation while the identified surgical operation is in progress.

85.A computer program product according to Claim 84 further comprising:

computer readable program code that, after providing secure communication of the anesthesia record to the client device, retrieves updated information including at least one selected from the group consisting of a new event occurring during the surgical operation, a new measurement of vital signs, and a new drug administered; and

computer readable program code that, after retrieving the updated information, provides secure communication of the updated information to the client device for display of an update of the anesthesia record at the client device while the identified surgical operation is in progress.

86.A computer program product according to Claim 82 wherein the anesthesia record comprises a graphical representation of events occurring during the identified surgical operation for display at the client device, the graphical representation including a time line divided into predetermined units of time with a plurality of events occurring during a period of time represented by a single unit on the time line being represented by respective discreet and distinguishable event icons.

87.A computer program product according to Claim 86 further comprising:

computer readable program code that accepts selection of one of the discreet and distinguishable event icons; and

computer readable program code that, responsive to accepting selection of one of the discreet and distinguishable event icons, provides text identifying the event corresponding to the selected discreet and distinguishable event icon for display at the client device.

88.A computer program product according to Claim 82 wherein the computer readable program code that accepts entry of information identifying a surgical operation accepts entry of a selection of a patient identification.

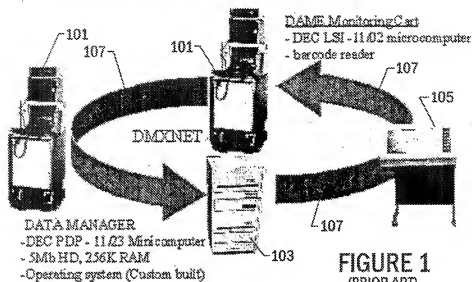
89.A computer program product according to Claim 88 wherein the patient identification includes at least one selected from the group consisting of a patient name, and a patient identification number.

90.A computer program product according to Claim 82 wherein the computer readable program code that accepts entry of information identifying a surgical operation accepts entry of a selection of a case identification.



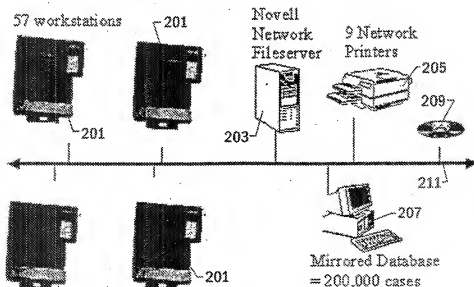
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## The DAME at Duke 1972



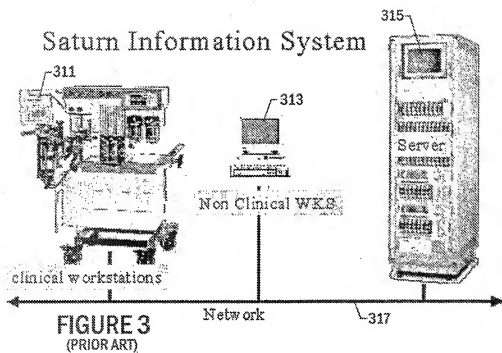
**FIGURE 1**  
(PRIOR ART)

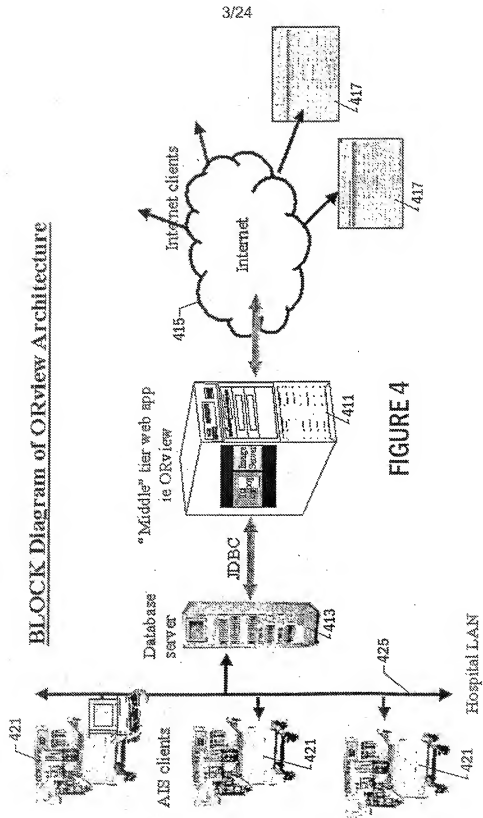
## Arkive at Duke 1992-1999



**FIGURE 2**  
(PRIOR ART)

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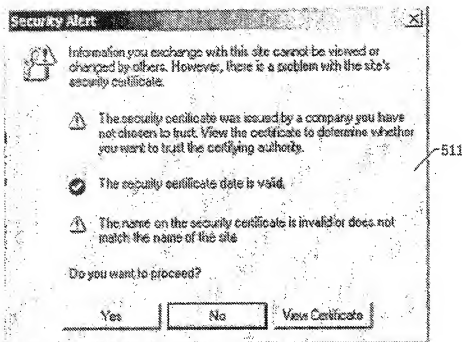


FIGURE 5

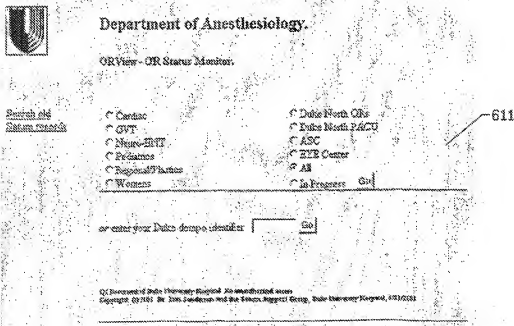


FIGURE 6

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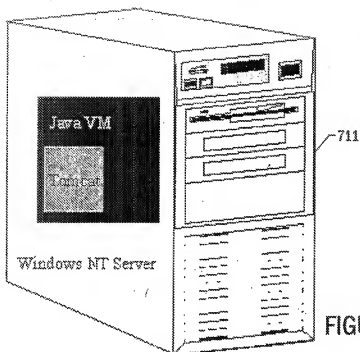


FIGURE 7

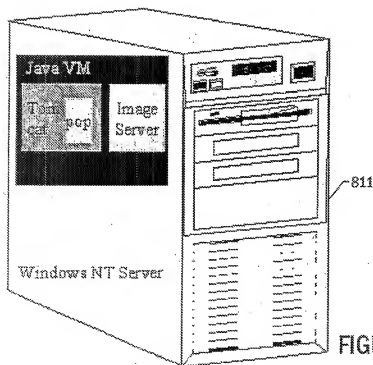


FIGURE 8

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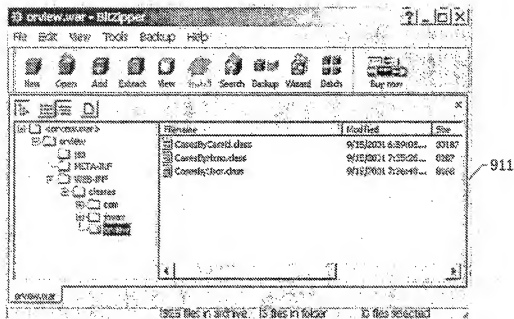


FIGURE 9

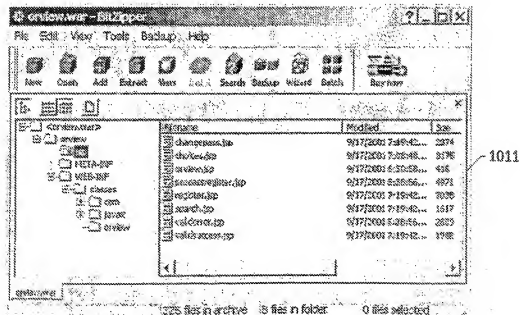


FIGURE 10

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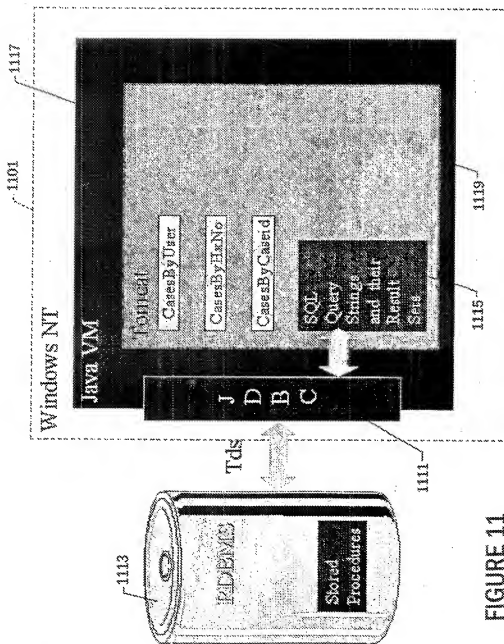


FIGURE 11





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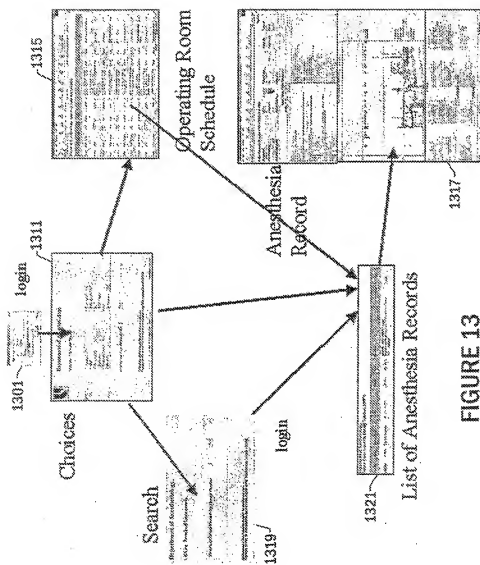


FIGURE 13

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# Department of Anesthesiology

OR View - OR Status Monitor

Search old  
Status records

- ☐ Cardiac
- ☐ GVT
- ☐ Neuro-ENT
- ☐ Pediatrics
- ☐ Regional/Plastics
- ☐ Womens
- ☐ Duke North ORs
- ☐ Duke North PACU
- ☐ ASC
- ☐ ETE Center
- ☐ All
- ☐ In Progress
- ☐ Go

or enter your Duke campus identifier

Go

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FIGURE 14

1311

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1319

## Department of Anesthesiology

ORView - Search old Saturn records

Search all Saturn Records by History Number

Go

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FIGURE 15





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## CasesByUser Servlet Flow

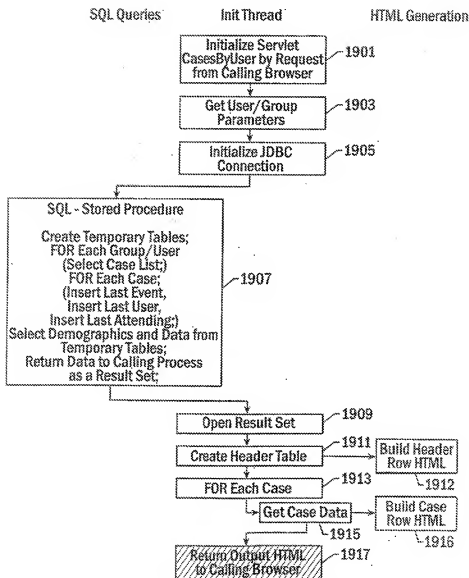


FIGURE 19

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## 1.1.1. The Anesthetic Record Page

**Duke University Hospital ANESTHESIA RECORD** Page 1 of 1

No. Doc. time Patient Room Hgt. 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Address: 10101 Research Road, Durham, NC 27705-10101

**Surgeon(s)** **ANAP** **Surg. Site** **Patient Name** **Weight lbs** **Sequence**

**Anesthetist(s)** **Location** **Age** **Sex** **Height cm** **Hx/Hx**

**Anesth. Physiologist(s)** **Anesthesia Type** **Diagnosis**

**Start/Stop/Total Procedure(s)**

**Age(s) 0-40 41-50 51-60 61-70 71-80 81-90 91-100 101-110 111-120 121-130 131-140 141-150 151-160 161-170 171-180 181-190 191-200 201-210 211-220 221-230 231-240 241-250 251-260 261-270 271-280 281-290 291-300 301-310 311-320 321-330 331-340 341-350 351-360 361-370 371-380 381-390 391-400 401-410 411-420 421-430 431-440 441-450 451-460 461-470 471-480 481-490 491-500 501-510 511-520 521-530 531-540 541-550 551-560 561-570 571-580 581-590 591-600 601-610 611-620 621-630 631-640 641-650 651-660 661-670 671-680 681-690 691-700 701-710 711-720 721-730 731-740 741-750 751-760 761-770 771-780 781-790 791-800 801-810 811-820 821-830 831-840 841-850 851-860 861-870 871-880 881-890 891-900 901-910 911-920 921-930 931-940 941-950 951-960 961-970 971-980 981-990 991-1000 1001-1010 1011-1020 1021-1030 1031-1040 1041-1050 1051-1060 1061-1070 1071-1080 1081-1090 1091-1100 1101-1110 1111-1120 1121-1130 1131-1140 1141-1150 1151-1160 1161-1170 1171-1180 1181-1190 1191-1200 1201-1210 1211-1220 1221-1230 1231-1240 1241-1250 1251-1260 1261-1270 1271-1280 1281-1290 1291-1300 1301-1310 1311-1320 1321-1330 1331-1340 1341-1350 1351-1360 1361-1370 1371-1380 1381-1390 1391-1400 1401-1410 1411-1420 1421-1430 1431-1440 1441-1450 1451-1460 1461-1470 1471-1480 1481-1490 1491-1500 1501-1510 1511-1520 1521-1530 1531-1540 1541-1550 1551-1560 1561-1570 1571-1580 1581-1590 1591-1600 1601-1610 1611-1620 1621-1630 1631-1640 1641-1650 1651-1660 1661-1670 1671-1680 1681-1690 1691-1700 1701-1710 1711-1720 1721-1730 1731-1740 1741-1750 1751-1760 1761-1770 1771-1780 1781-1790 1791-1800 1801-1810 1811-1820 1821-1830 1831-1840 1841-1850 1851-1860 1861-1870 1871-1880 1881-1890 1891-1900 1901-1910 1911-1920 1921-1930 1931-1940 1941-1950 1951-1960 1961-1970 1971-1980 1981-1990 1991-2000 2001-2010 2011-2020 2021-2030 2031-2040 2041-2050 2051-2060 2061-2070 2071-2080 2081-2090 2091-2100 2101-2110 2111-2120 2121-2130 2131-2140 2141-2150 2151-2160 2161-2170 2171-2180 2181-2190 2191-2200 2201-2210 2211-2220 2221-2230 2231-2240 2241-2250 2251-2260 2261-2270 2271-2280 2281-2290 2291-2300 2301-2310 2311-2320 2321-2330 2331-2340 2341-2350 2351-2360 2361-2370 2371-2380 2381-2390 2391-2400 2401-2410 2411-2420 2421-2430 2431-2440 2441-2450 2451-2460 2461-2470 2471-2480 2481-2490 2491-2500 2501-2510 2511-2520 2521-2530 2531-2540 2541-2550 2551-2560 2561-2570 2571-2580 2581-2590 2591-2600 2601-2610 2611-2620 2621-2630 2631-2640 2641-2650 2651-2660 2661-2670 2671-2680 2681-2690 2691-2700 2701-2710 2711-2720 2721-2730 2731-2740 2741-2750 2751-2760 2761-2770 2771-2780 2781-2790 2791-2800 2801-2810 2811-2820 2821-2830 2831-2840 2841-2850 2851-2860 2861-2870 2871-2880 2881-2890 2891-2900 2901-2910 2911-2920 2921-2930 2931-2940 2941-2950 2951-2960 2961-2970 2971-2980 2981-2990 2991-3000 3001-3010 3011-3020 3021-3030 3031-3040 3041-3050 3051-3060 3061-3070 3071-3080 3081-3090 3091-3100 3101-3110 3111-3120 3121-3130 3131-3140 3141-3150 3151-3160 3161-3170 3171-3180 3181-3190 3191-3200 3201-3210 3211-3220 3221-3230 3231-3240 3241-3250 3251-3260 3261-3270 3271-3280 3281-3290 3291-3300 3301-3310 3311-3320 3321-3330 3331-3340 3341-3350 3351-3360 3361-3370 3371-3380 3381-3390 3391-3400 3401-3410 3411-3420 3421-3430 3431-3440 3441-3450 3451-3460 3461-3470 3471-3480 3481-3490 3491-3500 3501-3510 3511-3520 3521-3530 3531-3540 3541-3550 3551-3560 3561-3570 3571-3580 3581-3590 3591-3600 3601-3610 3611-3620 3621-3630 3631-3640 3641-3650 3651-3660 3661-3670 3671-3680 3681-3690 3691-3700 3701-3710 3711-3720 3721-3730 3731-3740 3741-3750 3751-3760 3761-3770 3771-3780 3781-3790 3791-3800 3801-3810 3811-3820 3821-3830 3831-3840 3841-3850 3851-3860 3861-3870 3871-3880 3881-3890 3891-3900 3901-3910 3911-3920 3921-3930 3931-3940 3941-3950 3951-3960 3961-3970 3971-3980 3981-3990 3991-4000 4001-4010 4011-4020 4021-4030 4031-4040 4041-4050 4051-4060 4061-4070 4071-4080 4081-4090 4091-4100 4101-4110 4111-4120 4121-4130 4131-4140 4141-4150 4151-4160 4161-4170 4171-4180 4181-4190 4191-4200 4201-4210 4211-4220 4221-4230 4231-4240 4241-4250 4251-4260 4261-4270 4271-4280 4281-4290 4291-4300 4301-4310 4311-4320 4321-4330 4331-4340 4341-4350 4351-4360 4361-4370 4371-4380 4381-4390 4391-4400 4401-4410 4411-4420 4421-4430 4431-4440 4441-4450 4451-4460 4461-4470 4471-4480 4481-4490 4491-4500 4501-4510 4511-4520 4521-4530 4531-4540 4541-4550 4551-4560 4561-4570 4571-4580 4581-4590 4591-4600 4601-4610 4611-4620 4621-4630 4631-4640 4641-4650 4651-4660 4661-4670 4671-4680 4681-4690 4691-4700 4701-4710 4711-4720 4721-4730 4731-4740 4741-4750 4751-4760 4761-4770 4771-4780 4781-4790 4791-4800 4801-4810 4811-4820 4821-4830 4831-4840 4841-4850 4851-4860 4861-4870 4871-4880 4881-4890 4891-4900 4901-4910 4911-4920 4921-4930 4931-4940 4941-4950 4951-4960 4961-4970 4971-4980 4981-4990 4991-5000 5001-5010 5011-5020 5021-5030 5031-5040 5041-5050 5051-5060 5061-5070 5071-5080 5081-5090 5091-5100 5101-5110 5111-5120 5121-5130 5131-5140 5141-5150 5151-5160 5161-5170 5171-5180 5181-5190 5191-5200 5201-5210 5211-5220 5221-5230 5231-5240 5241-5250 5251-5260 5261-5270 5271-5280 5281-5290 5291-5300 5301-5310 5311-5320 5321-5330 5331-5340 5341-5350 5351-5360 5361-5370 5371-5380 5381-5390 5391-5400 5401-5410 5411-5420 5421-5430 5431-5440 5441-5450 5451-5460 5461-5470 5471-5480 5481-5490 5491-5500 5501-5510 5511-5520 5521-5530 5531-5540 5541-5550 5551-5560 5561-5570 5571-5580 5581-5590 5591-5600 5601-5610 5611-5620 5621-5630 5631-5640 5641-5650 5651-5660 5661-5670 5671-5680 5681-5690 5691-5700 5701-5710 5711-5720 5721-5730 5731-5740 5741-5750 5751-5760 5761-5770 5771-5780 5781-5790 5791-5800 5801-5810 5811-5820 5821-5830 5831-5840 5841-5850 5851-5860 5861-5870 5871-5880 5881-5890 5891-5900 5901-5910 5911-5920 5921-5930 5931-5940 5941-5950 5951-5960 5961-5970 5971-5980 5981-5990 5991-6000 6001-6010 6011-6020 6021-6030 6031-6040 6041-6050 6051-6060 6061-6070 6071-6080 6081-6090 6091-6100 6101-6110 6111-6120 6121-6130 6131-6140 6141-6150 6151-6160 6161-6170 6171-6180 6181-6190 6191-6200 6201-6210 6211-6220 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8221-8230 8231-8240 8241-8250 8251-8260 8261-8270 8271-8280 8281-8290 8291-8300 8301-8310 8311-8320 8321-8330 8331-8340 8341-8350 8351-8360 8361-8370 8371-8380 8381-8390 8391-8400 8401-8410 8411-8420 8421-8430 8431-8440 8441-8450 8451-8460 8461-8470 8471-8480 8481-8490 8491-8500 8501-8510 8511-8520 8521-8530 8531-8540 8541-8550 8551-8560 8561-8570 8571-8580 8581-8590 8591-8600 8601-8610 8611-8620 8621-8630 8631-8640 8641-8650 8651-8660 8661-8670 8671-8680 8681-8690 8691-8700 8701-8710 8711-8720 8721-8730 8731-8740 8741-8750 8751-8760 8761-8770 8771-8780 8781-8790 8791-8800 8801-8810 8811-8820 8821-8830 8831-8840 8841-8850 8851-8860 8861-8870 8871-8880 8881-8890 8891-8900 8901-8910 8911-8920 8921-8930 8931-8940 8941-8950 8951-8960 8961-8970 8971-8980 8981-8990 8991-9000 9001-9010 9011-9020 9021-9030 9031-9040 9041-9050 9051-9060 9061-9070 9071-9080 9081-9090 9091-9100 9101-9110 9111-9120 9121-9130 9131-9140 9141-9150 9151-9160 9161-9170 9171-9180 9181-9190 9191-9200 9201-9210 9211-9220 9221-9230 9231-9240 9241-9250 9251-9260 9261-9270 9271-9280 9281-9290 9291-9300 9301-9310 9311-9320 9321-9330 9331-9340 9341-9350 9351-9360 9361-9370 9371-9380 9381-9390 9391-9400 9401-9410 9411-9420 9421-9430 9431-9440 9441-9450 9451-9460 9461-9470 9471-9480 9481-9490 9491-9500 9501-9510 9511-9520 9521-9530 9531-9540 9541-9550 9551-9560 9561-9570 9571-9580 9581-9590 9591-9600 9601-9610 9611-9620 9621-9630 9631-9640 9641-9650 9651-9660 9661-9670 9671-9680 9681-9690 9691-9700 9701-9710 9711-9720 9721-9730 9731-9740 9741-9750 9751-9760 9761-9770 9771-9780 9781-9790 9791-9800 9801-9810 9811-9820 9821-9830 9831-9840 9841-9850 9851-9860 9861-9870 9871-9880 9881-9890 9891-9900 9901-9910 9911-9920 9921-9930 9931-9940 9941-9950 9951-9960 9961-9970 9971-9980 9981-9990 9991-10000**

**EVENTS**

**MONITORED VITAL SIGNS**

**DRUGS**

**GASES AND FLUIDS**

**LABS AND PERIOPERATIVE TOTALS**

FIGURE 20





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## 1.1.1.1. The Servlet CasesByCaseId - Pseudocode and Flow Diagram

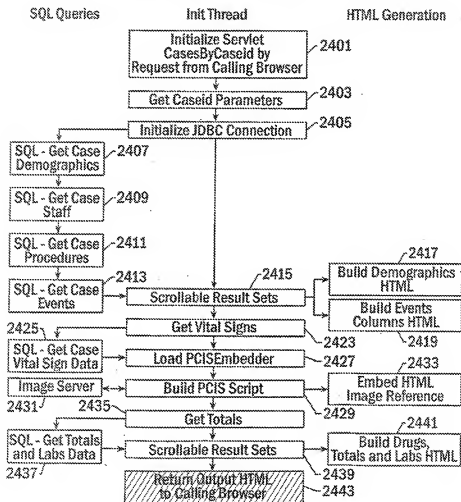
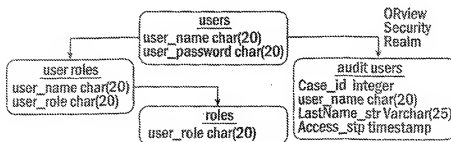
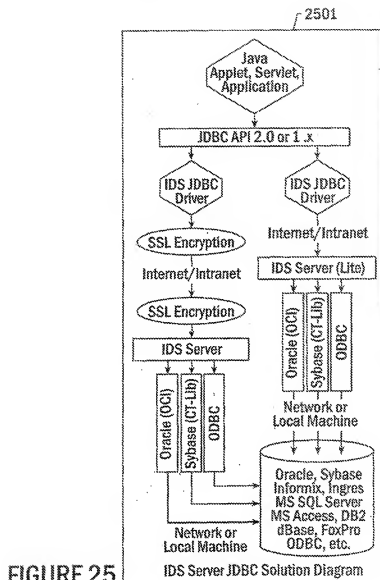
CasesByCaseId Servlet Flow

FIGURE 24

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2701

2 (2)

**Enter Username & Password**

Please type your user name and password

Site: 15237674

Room: J0800000


User Name: j0800000

Password: [REDACTED]

☐ Save this password in your password list

FIGURE 27

2801

 **Department of Anesthesiology.**

ORView - OR Status Monitor and Anesthesia Record.

Hello j0800000. Use this form to change your password.

Please type your existing password: [REDACTED]

Enter your new password: [REDACTED]

FIGURE 28

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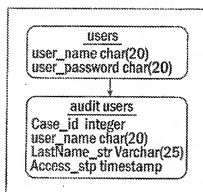


FIGURE 29

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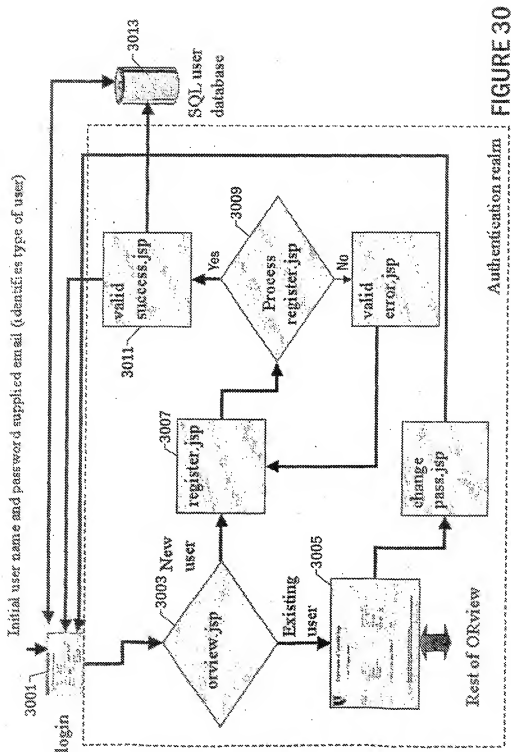


FIGURE 30

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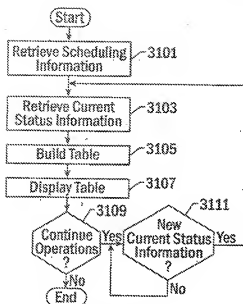


FIGURE 31

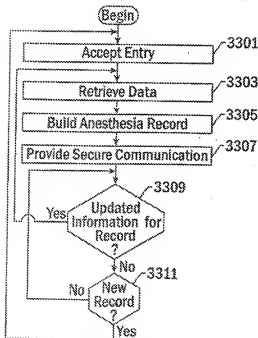


FIGURE 33

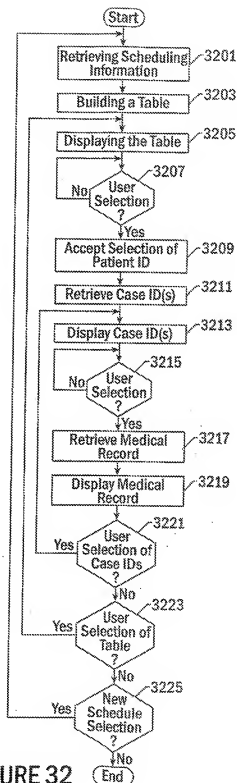
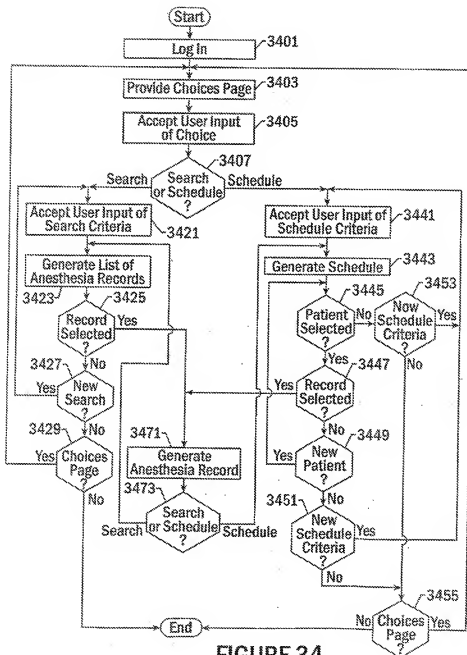
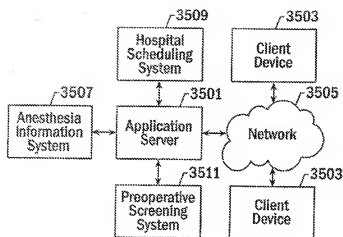


FIGURE 32

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**FIGURE 35**